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Long Term Effects of the Barge FLORIDA Oil Spill

Woods Hole Oceanographic Institution, MA

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Jan 81

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16. ABSTRACT

To determine carefully the effects on the marine and estuarine benthos of #2 fuel oil spilled by the barge FLORIDA off West Falmouth, Massachusetts, we sampled for many months along an onshore-offshore gradient of pollution, and less intensively at unoiled sites. Analyses of hydrocarbons established that pollution was greatest and most persistent in the intertidal and subtidal zones of Wild Harbor River, less severe in degree and duration at stations farthest from shore. A variety of concurrent analyses showed that disturbance of the fauna was most severe and longest lasting at the most heavily oiled sites, and least severe but perceptible at lightly oiled stations. Patterns of disturbance were not related to granulometry of the sediments. Plants, crustaceans, fish, and birds suffered both high mortality immediately after the spill, and physiological and behavioral abnormalities directly related to high concentrations of the fuel oil. Five years after the spill its effects on the biota were still detectable, and partly degraded #2 fuel oil was still present in the sediments in Wild Harbor River and estuary.

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LONG TERM EFFECTS OF THE BARGE FLORIDA OIL SPILL

by

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FOREWORD

The Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment. The complexity of that environment and the interplay between its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution, and it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems for the prevention, treatment and management of wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, for the preservation and treatment of public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research; a most vital communications link between the researcher and the user community.

This report describes the effects on marine and estuarine benthos of a #2 fuel oil spill. A variety of concurrent analyses was carried out systematically over time and space and showed that the effects of the spill on the biota were still detectable after five years. This report and the techniques described in it will be of interest to all those concerned with cleaning up oil spills in inland and coastal waters.

Francis T. Mayo
Director
Municipal Environmental Research
Laboratory

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ABSTRACT

To determine carefully the effects on the marine and estuarine benthos of #2 fuel oil spilled by the barge FLORIDA off West Falmouth, Massachusetts, we sampled for many months along an onshore-offshore gradient of pollution, and less intensively at unoiled sites. Analyses of hydrocarbons established that pollution was greatest and most persistent in the intertidal and subtidal zones of Wild Harbor River, less severe in degree and duration at stations farthest from shore. A variety of concurrent analyses showed that disturbance of the fauna was most severe and longest lasting at the most heavily oiled sites, and least severe but perceptible at lightly oiled stations. Patterns of disturbance were not related to granulometry of the sediments. Plants, crustaceans, fish, and birds suffered both high mortality immediately after the spill, and physiological and behavioral abnormalities directly related to high concentrations of the fuel oil. Five years after the spill its effects on the biota were still detectable, and partly degraded #2 fuel oil was still present in the sediments in Wild Harbor River and estuary.

This report was submitted in fulfillment of Grant No. R801001-02 by the Woods Hole Oceanographic Institution under the sponsorship of the U.S. Environmental Protection Agency. The report covers a period from September 1969 to June 1974, and was completed as of March 1979.

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LIST OF SYMBOLS

Unless expressly indicated otherwise, the following symbols denote stations on the figures:

cross	station 31
open circle	station 9
closed circle	station 10
closed semicircle	station 30
open diamond	station 5
open square	station 20
closed square	station 35
open triangle	station II
closed triangle	station IV
S	Sippewissett Marsh

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SECTION 1

INTRODUCTION

Early in the morning of September 16, 1969, the barge FLORIDA ran aground on a rocky shoal off Fassett's Point, West Falmouth, Massachusetts, and spilled 650,000 to 700,00 liters of #2 fuel oil into Buzzards Bay (Figure 1-3). Strong SSW winds, common to this region, churned the oil into an oil-water emulsion and drove it northeastward into Wild Harbor River in North Falmouth. The oil spread over more than 1000 acres, including four miles of coastline (Souza, 1969). Mass mortality of at least the larger marine animals quickly supervened in the intertidal and subtidal zones of the river.

Water-based emulsifiers, claimed by the manufacturers to be non-toxic, were initially used to clean up the oil. The company hired to remove the oil first applied these emulsifiers in Wild Harbor on the evening of September 16, and made further applications the next day. On September 18 and 19 the company introduced emulsifiers into the waters from the beach south of Wild Harbor before being restrained by official act on the grounds that the emulsifiers were toxic to shellfish. The company poured a total of 17,072 liters of emulsifiers into the waters in less than four days. These chemicals were not, however, the chief cause of death, for animals had already begun to die in large numbers at least four hours before the first emulsifiers were applied. As Murphy (1970) states, ". . . most spills of any magnitude of distillate fuel oils have resulted in a significant kill of marine life". (See also Adam, 1936; Tegelberg, 1964; North, Neushul, and Clendenning, 1965; Goodring, 1971; Croker, 1969).

In the initial period of study we made several observations. Within only eight to ten days and at the relatively high temperatures of 18 to 21°C, carcasses of most soft-bodied animals completely decomposed. Skeletons were soon disarticulated and scattered. Both intertidal and subtidal sediments, particularly sands, became physically unstable, probably owing to disintegration of animal secretions and tubes, and death of vegetation and benthic algae that bound the sediment. Marsh grasses reached by water-borne oil during the first three weeks after the spill died. The pollution-indicator polychaete, *Capitella*, increased explosively to occupy the river bottom in very dense concentrations. By late spring and early summer of 1970 the numbers of this polychaete crashed, and a few other species were able to occupy this area. In the spring of 1970 the gonads of blue mussels, *Mytilus edulis*, surviving in the affected area were thin and sterile, whereas gonads of blue mussels in unpolluted Sippewissett Marsh were plump and ripe. Some mortality always attended oil in the sediments; the greater the concentration of oil, the heavier the mortality. In sediments saturated with oil the extinction of

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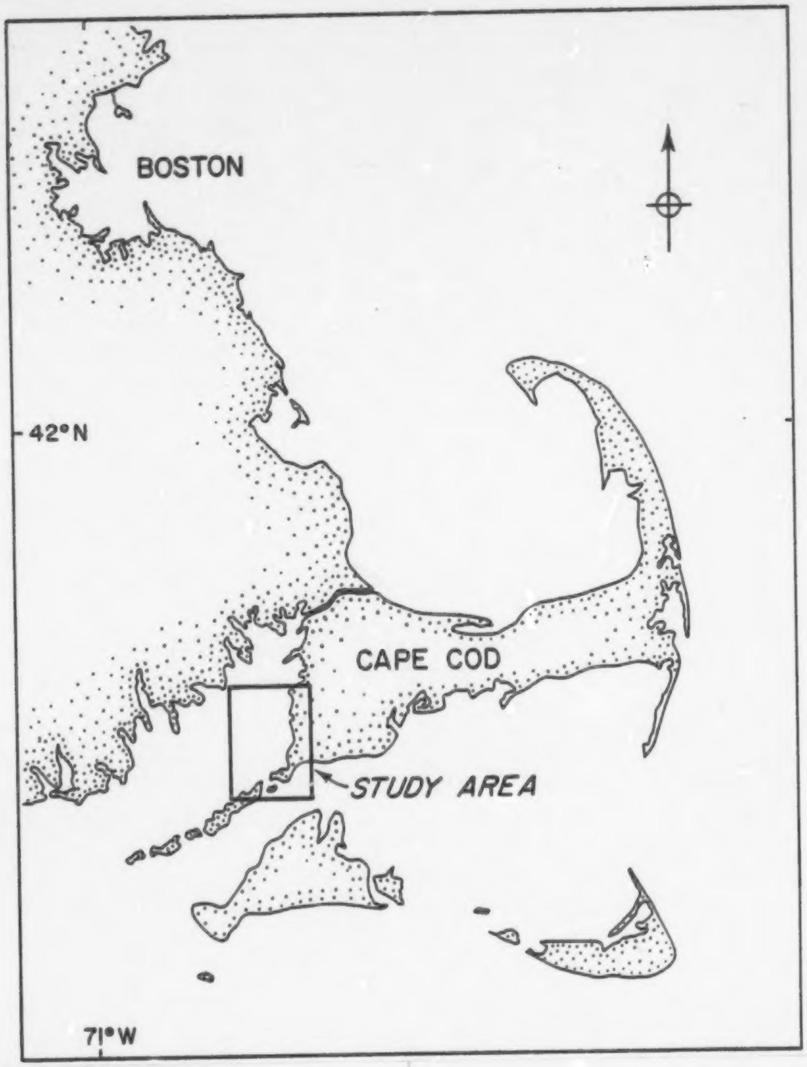

Figure 1. Map of Southeastern Massachusetts showing location of study area in Eastern Buzzards Bay.

life was sometimes almost complete.

In order to study spatial and temporal changes in concentration and

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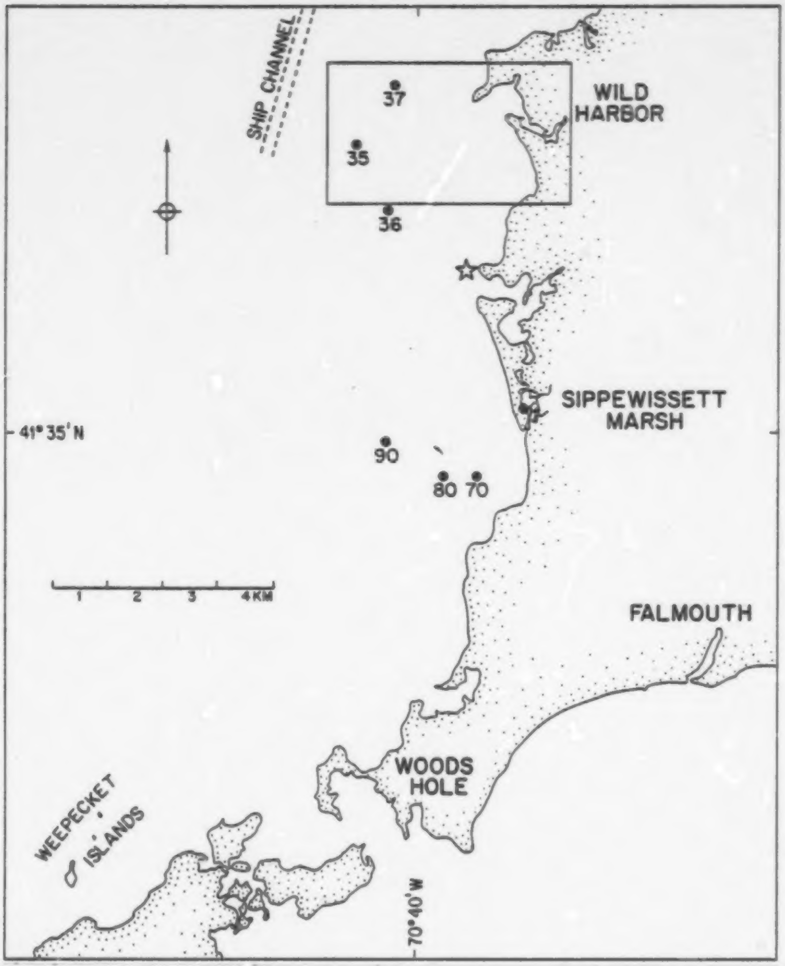
SHIP CHANNEL
37
35
36
WILD HARBOR
SIPPEWISSETT MARSH
41° 35' N
90
80
70
1
2
3
4 KM
FALMOUTH
WOODS HOLE
WEEPECKET ISLANDS
70° 40' W

Figure 2. Map of study area showing site of grounding of barge FLORIDA (star) and major clusters of samples. Intensively sampled area in box.

composition of the fuel oil, and like changes in density and character of the benthic fauna, our long-term strategy was monthly or bimonthly sampling at stations along a gradient from most severe effects in Wild Harbor River to least effects at offshore stations in Buzzards Bay. For the intensively sampled stations we considered granulometry of sediments, composition of hydrocarbons, and quantitative and qualitative changes in the fauna (including patterns of dominance, constancy, numerical variability, and diversity.

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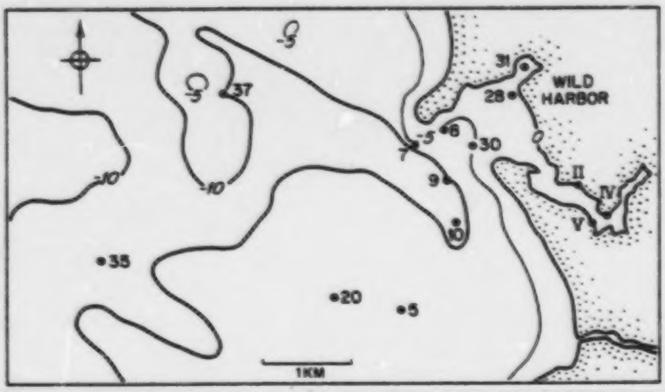

Figure 3. Intensively sampled Wild Harbor River area, showing location of stations and bathymetry. Contour interval is five meters.

This report may seem too detailed. It is our conscious purpose to give the details. We wish to countervail against the all-too-common, strongly stated, apparently unequivocal conclusions that are, at best, equivocal interpretations of insufficient and ambiguous data. Such inadequacies are usual in many pollution-related studies of benthic ecology, including those on which important decisions are based. Through detailed presentation and analysis of the data, we aim to demonstrate more than adequately the persistent, deleterious effects of #2 fuel oil on the marine benthos.

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SECTION 2

CONCLUSIONS

1. The petroleum hydrocarbons in the sediments of Wild Harbor River and adjacent areas offshore came from the #2 fuel oil spilled by the FLORIDA on September 16, 1969. Concentrations were highest and degradation slowest in the intertidal and subtidal zones of the river. Concentrations were lowest at stations farthest from shore.

2. Oil spread seaward from the areas of highest concentration for at least five years. After this span of time, fuel oil which was only somewhat degraded was still detectable in the peat and sediments of the river.

3. Within twelve hours after the spill, marine animals began to die in great numbers. Mortality was most severe and longest lasting in the river, less at nearshore subtidal stations, and least and of shortest duration at the more distant offshore stations. This trend in mortality was especially evident among ampeliscid amphipods.

4. The opportunistic polychaete, *Capitella*, monopolised the biologically denuded substrata at the heavily oiled stations for the first eleven months after the spill, then crashed. At the offshore stations, *Mediomastus ambiseta*, another capitellid polychaete, became common nearly a year after the spill, and remained so during the second year at intermediately oiled stations, but soon declined in numbers at lightly oiled stations.

5. Faunal changes matched in intensity and duration the gradient of pollution by #2 fuel oil from the FLORIDA, but were only occasionally related to granulometry of the sediments.

The fauna in Wild Harbor River was unstable in density, diversity, and composition. Fluctuations in composition were successional. After more than five years the fauna there had only slightly recovered.

At the nearshore subtidal stations, faunal fluctuations were rapid and very broad in the first year, and successively less in later years. After the first year, changes in composition began to alter in character from successional to seasonal. Recovery had begun, but was not very far advanced by the end of two and one-half years.

Faunal changes at stations farthest from shore were relatively slight and seasonal in nature. The fauna recovered in density, number of species, and diversity after about a year.

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At unoiled stations, faunal changes were slight and seasonal.

6. Increased species richness usually contributed more to recovery of diversity than did increase in the evenness with which individuals were distributed among species.

7. Even if the fauna began to recover in diversity and density, the animals continued to suffer the ill effects of the oil. Physiological and behavioral disorders caused by the oil resulted in impairment of growth and reproduction, and in death.

8. Bacterial seeding in areas heavily polluted by oil is probably inadequate to hasten the degradation of petroleum hydrocarbons.

9. Faunal surveys undertaken more than a week after an incident of oil pollution probably will not find any of the larger soft-bodied animals killed by the oil.

10. Most necessary are carefully conducted, quantitative, long-term studies, especially those designed to detect physiological and behavioral damage, of the effects of oil spills on all levels of the marine trophic structure, the apical member of which is often man. Mathematical techniques, particularly diversity indices, must be used with comprehension and care. Only through such studies can society appreciate the true price paid for the undramatic, pervasive, ever-spreading, chronic pollution which disrupts and alters increasingly great reaches of natural habitats.

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SECTION 3

METHODS

Field Work

On September 19, 1969, three days after the spill, we began to collect samples in the intertidal zone of Wild Harbor River, at six sites marked with stakes. Within the next week, we began collecting at many subtidal stations in the affected area. Within two months after the spill we were able to determine the onshore-offshore gradient of effects, and limited further sampling to stations along that gradient. These stations, 31, 9, 10, 5, 20, and 35, we marked with anchored buoys (Figure 3). Even though the buoys disappeared during the second winter, we were able to relocate stations to within a few feet by fathometer, bearings, compass bearings, and fixed-range radar. We later established, and collected samples in, control areas in and offshore from Sippewissett Marsh, well to the windward of Fassett's Point (Figure 2). Ice and rough seas sometimes prevented collecting during the winter. We collected 413 sets of samples, 42% of which were picked for animals. Each set of intertidal samples consisted of a principal 1/128 m^2 core for faunal analysis, a replicate sample of the same size, and surficial sediment for hydrocarbon and granulometric analyses. This third sample was taken with a spoon or trowel from a square 15 cm on a side to a depth of 4 cm (900 cc). Each set of subtidal samples consisted of one or two 1/25 m^2 Van Veen grab samples for faunal analysis, and another such sample for hydrocarbon and granulometeric analyses. The uppermost 4 cm of this last grab sample was retained, the rest was discarded. In the field we noted the presence of oil in the sediments and on animals, the anaerobic condition of some substrata, and the presence of dead animals and plants.

Treatment of Biological Samples

We washed the samples for biological analysis on a U. S. standard #50 mesh (opening = 0.297 mm), preserved them in 5% buffered formalin, transferred them after 24 hours to unbuffered 70% ethyl alcohol, and stained them with rose bengal. We picked the animals from the washed sediments under binocular microscopes. We extracted 280 species of animals, including 108 polychaetes, 34 bivalves, 39 gastropods, 47 amphipods, and 52 other taxa, a total of 347,165 individuals. Details appear in Appendix A. Both the very abundant nematodes and the meiofauna were too small to be sampled adequately with a 0.297 mm sieve, and were omitted from the analyses.

Granulometric Analysis

The sediments were analyzed to determine the extent to which faunal

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patterns were related to character of the substratum rather than to presence of oil. Analysis was limited to sediments from stations sampled for at least a year, stations II, IV, 31, 30, 9, 10, 5, 20, and 35. The approximate size of the samples was from five to 35 grams. Each sample taken for these and hydrocarbon analyses was homogenized, and a given quantity was removed for the hydrocarbon analysis. The remnant, if any, was used for sedimentary analysis.

Samples from all stations except 31, which was much muddier than the others, were treated in the manner to be described.

First the sample was wet-sieved on #10 (2 mm, -1 ϕ) and #230 (0.0625 mm, 4 ϕ) U. S. standard meshes to separate it into the gravel, sand, and mud fractions. The gravel, freed of shells and plant debris, was dried and weighed. The sand was washed with acetone to remove organic molecules, dried, weighed, and put in the WHOI Rapid Sediment Analyzer (Schlee, 1966), which produced a strip chart which was analyzed for distribution of material among the five size classes of sand. The mud fraction was washed into a 1000-ml cylinder, 30 ml of 0.5 N sodium hexametaphosphate (Calgon) solution and enough water added to bring the level up to 1000 ml. After the mixture was thoroughly stirred and allowed to stand for 24 hours to check for flocculation, the mud and water were thoroughly stirred again, and 20 ml of the mixture was removed after 20 seconds from a depth of 20 cm by pipette, transferred to a beaker, dried, and weighed. This weight, multiplied by 50, gave the total weight of mud in the sample. At one minute and 49 seconds, 7 minutes and 15 seconds, 28 minutes and 59 seconds, 20 ml aliquots were withdrawn from a depth of 10 cm by pipette, released in beakers, dried, and weighed to give the proportions of clay and silt in the fine fraction.

Samples from station 31 were sandy muds containing large amounts of #2 fuel oil. They were first washed with acetone, dried, and weighed, then wet-sieved on a #230 mesh to separate sand from mud. The sand was dried and weighed. The mud was centrifuged to separate silt from clay, and the silt was dried and weighed. Weight percents of sand, silt, and clay were calculated.

Cumulative curves were plotted on probability paper for all samples for which information was sufficient, and quartiles determined graphically for derivation of median, sorting, and skewness. Because the gravel and mud fractions were not analyzed in detail, it was impossible to fix the tails of the curves, and therefore impossible to use more sensitive measures to characterize the sediments. In the few cases in which mud constituted more than 25% by weight of the sample, the third quartile was estimated by continuing the line connecting the two previous points through the 75th percentile, and reading the phi value intersected. The phi-scale equivalents of Trask's sorting and skewness measures were calculated and described in terms set forth in Folk (1974). The central tendency was expressed by the median, the similarity among the central 50% of the grains by phi quartile deviation (sorting), and asymmetry of the distribution by phi quartile skewness. The Wentworth scale of size classes was used in the descriptions. In this scale, each successively finer class is half the width arithmetically of its predecessor. For statistical manipulation, we have used the phi scale, in which

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the phi units are the logarithm to the base 2 of the Wentworth classes. Conversion tables appear in Folk (1974) and Krumbein (1939).

Because the samples were small, special care was taken to avoid error. During sieving, fines were completely washed from the sands. A balance more accurate than necessary was used. To prevent samples from absorbing water from the air, fractions were stored in a dessicator. In the RSA analysis, too large a sample resulted in artificial enhancement of the finer size classes, while too small a sample resulted in a low curve from which data were extracted only with difficulty. Any error in the pipette analysis of very small fractions of mud was magnified fifty fold, giving values less reliable than those for weightier fractions. In a few cases, replicate analyses by the same technique were run; agreement was very good. Measurement of the mud fractions are probably reliable within 2%, measurement by RSA probably slightly less reliable.

Analysis of Hydrocarbons

Oil is almost infinitely complex. The thousands of different molecules in any crude oil, ranging from 16 to more than 20,000 in molecular weight, are products of diagenesis and bacterial action beneath the surface of the earth under anaerobic conditions over spans of thousands to millions of years. As Blumer and Sass (1972a)remark, "The diagenetic processes involved in petroleum formation at depth randomize the sedimentary organic matter through inter- and intramolecular scrambling and produce a hydrocarbon mixture of enormous complexity which cannot be resolved completely by present medium or high resolution chromatography." Most of the different molecules belong to a few major homologous groups of saturated hydrocarbons. Biogenic hydrocarbons, however, are synthesized through specific natural processes to yield a limited suite of compounds within a relatively narrow range of molecular weights. Up to at least C_{22} biogenic hydrocarbons can be resolved into individual compounds by medium-resolution gas chromatography. Only a few members of each homologous group occur in any one kind of organism. Frequently, only one hydrocarbon group is present and commonly a single hydrocarbon predominates. The most diagnostic features of organic hydrocarbons in coastal sediments are the strong predominance of normal alkanes with odd numbers of carbon atoms (Stevens, *et al.*, 1956)and the absence of the unresolved envelope typical of crude oil and its products. Biogenic hydrocarbons of this sort occurred in Buzzards Bay before the FLORIDA spill (Clark and Blumer, 1967). The many differences between biogenic and petroleum hydrocarbons (Table 1) identify the source of hydrocarbons at a possibly polluted site.

Four processes, evaporation, dissolution, biodegradation, and chemical degradation, change oil. Dissolution as used here is defined operationally as the accommodation of the oil in water by true solution, emulsion, or any other process. Dissolution results in the removal of oil from the sediments to overlying or interstitial water or both.

Blumer and his colleagues used gas chromatography and mass spectrometry to identify the #2 fuel oil from the FLORIDA and to measure rates of degradation of the different components with time (Blumer, 1971; Blumer and Sass,

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1972a, b, c; Blumer, Souza, and Sass, 1970a, b; Blumer, Souza, Sass, Sanders, Grassle, and Hampson, 1970).

TABLE 1. MAJOR DIFFERENCES BETWEEN PETROLEUM AND BIOGENIC HYDROCARBONS

Hydrocarbon	Petroleum	Biogenic
n-Alkanes	Odd and even numbers of C atoms nearly equally abundant Adjacent members of series usually vary little in concentration	Odd numbers of C atoms much more abundant than even numbers
Aromatics	Many and complex (polybenzenes and naphthalenes, polynuclear aromatics with multiple alkyl substitutions, naphthene-aromatics)	Simple, with one or two alkyl substitutions at most
Cycloalkanes (Naphthenes)	Heterogeneous; those with substituted rings more abundant than their parent compounds	Uncommon; one- to three-chain rings
Alkanes (Olefins)	Usually absent in crude oil; may occur in refined petroleum	Major portion of biologic hydrocarbons

They measured the mass of hydrocarbons in 100 g of dry sediment. The average concentration of biogenic hydrocarbons forming the normal background in Buzzards Bay is 5 - 7 mg/100 g dry sediment, with 10 mg nearly maximal (Blumer and Sass, 1972a). Sediments are considered polluted if concentrations perceptibly exceed this background. That concentrations are within the normal background need not mean that the hydrocarbons are biogenic. If the hydrocarbons are not the products of biologic synthesis, then oil pollution has occurred. They studied the temporal changes in the boiling point envelope. The lighter fractions of oil evaporate and dissolve more rapidly than the heavier fractions, so that the boiling point envelope retreats toward the higher carbon numbers and stabilizes there upon depletion of the lighter fractions (Blumer and Sass, 1972a). The envelope stabilizes more rapidly and at higher carbon numbers with increased temperature.

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Stabilization is also more rapid in coarser and well-sorted sediments. Biogenic hydrocarbons lack the unresolved boiling point envelope typical of crude oil and its products.

They measured the degradation of straight and branched alkanes. Straight alkanes are degraded more rapidly than their branched isomers in both the laboratory and field. The ratio of n-heptadecane (n-C_{17}) to pristane was a sensitive index of the initial stages of biodegradation in West Falmouth (Blumer, Souza, and Sass, 1970b). The value of this ratio for the unaltered #2 fuel oil spilled by the FLORIDA was 1.67, but successively lower as biodegradation progressed.

They studied the degradation of adjacent homologues. Adjacent members of the same or adjacent homologous series break down at nearly the same rate; their relative concentrations vary only slightly as oil ages. Because oils (and their refined products) have different compositions, and therefore different concentration ratios, these ratios identify an oil and its refined products, regardless of age. Blumer and his colleagues used the ratio of the adjacent homologues of the branched isoprenoid alkane series, pristane (tetramethylpentadecane) and phytane (pentamethylpentadecane), to identify the polluting oil in its spread and degradation. Residues of the #2 fuel oil spilled by the FLORIDA in Buzzards Bay and incorporated in the sediments contained isoprenoid alkanes from C_{13} to at least C_{20} (Blumer and Sass, 1972c). The members with the highest boiling points, pristane (C_{19}) and phytane (C_{20}), are little affected by solution at ambient temperatures. Decrease in amplitude of the pristane and phytane peaks relative to the unresolved background envelope represents biodegradation beyond the incipient stage.

Lateral and Temporal Variation of the Fauna

We used many graphic and mathematical techniques to analyze the stability of the fauna. Each method examined a different aspect of the changes in density and composition along the onshore-offshore gradient of pollution.

We examined changes in density and number of species at intertidal stations II and IV and subtidal stations 31, 30, 9, 10, 5, 20, and 35, and analyzed the degree and rapidity of fluctuations. We paid especial attention to the invasion and dominance of opportunistic species. Opportunists are those species which discover a habitat quickly, reproduce rapidly so as to exploit the resources sooner than can other species, and, having exhausted those resources or having befouled the habitat, die in great numbers or move to other areas (Wilson and Bossert, 1971). Opportunists are the index of ephemeral, unpredictable, and disturbed habitats. The chief opportunists near West Falmouth were capitellid polychaetes, *Mediomastus ambiseta* and two or more sibling species of *Capitella* (Grassle and Grassle, 1976). *Mediomastus* was abundant offshore, *Capitella* in Wild Harbor River. We used BMD P1V one-way analysis of variance and covariance to evaluate rates of mortality at stations 9, 10, 20, and 35 in the year after July, 1970.

We studied changes in the proportions and identities of the subdominant species at most of these same stations and in Sippewissett Marsh. Seasonal assemblages composing a relatively small proportion of the fauna without the

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one most dominant polychaete betoken health. Successional assemblages making up a large portion of the partial fauna are signs of disturbance. We arbitrarily designated as subdominant any species which, in the absence of the one most abundant species, composed at least 10% of the fauna.

We also examined changes in density of ampeliscid amphipods. Counts of dead animals were based on fragments of heads retained on the #50 mesh sieve. These heads have four brightly pigmented, easily identifiable, decay-resistant eye lenses. Upon restudying our samples, we made small changes in the data previously published (Sanders, Grassle, and Hampson, 1972; Sanders, 1974). Trends remained unaltered, however. Owing to their high sensitivity to moderate quantities of oil (here, about 15 mg/100 g dry sediment), ampeliscid amphipods are excellent indicators of oil pollution (Stander and Ventner, 1968).

We used temporal changes in density to determine the effect of #2 fuel oil on the benthic fauna. To this end we measured the month-to-month variation at intensively sampled stations 31, 9, 10, 20, and 35 of a species with a mean abundance of three or more in 1/25 m^2 at one or more stations. We used the coefficient of variation (standard deviation/mean) to measure this variation. The more affected that species, the greater the variation in abundance and the greater the coefficient of variation.

We evaluated patterns of constancy of species from stations II, IV, 31, 9, 10, 5, 20, 35, and Sippewissett Marsh. Constancy measures the extent to which a species is a constant member of the biota at a station, and is the percentage of analyzed samples in which the species occurs. The samples from stations II, IV, and Sippewissett Marsh, each 1/128 m^2, are comparable among themselves, as are the samples from stations 31, 9, 10, 5, 20 and 35, each 1/25 m^2. The two sets are not comparable. All were retained on a #50 mesh sieve. We included only those species occurring in more than 45% of the samples from a station. Generally, species less constant than 0.45 were very much less constant. A high proportion of very constant species is indicative of a healthy, stable fauna; a high proportion of low-constancy species indicates a fluctuating, disturbed fauna.

We also used a weighted ratio to express the year-to-year differences in the density of each species. This weighted ratio is the discrepancy index, Z_i. For each species the index is composed of two parts: density, the sum of the mean densities of the two years considered ($X_i + Y_i$), and disparity, the ratio of the larger mean density to the smaller (X_i/Y_i). The larger the value of this ratio, the greater the disparity. The formula for the discrepancy index is:

$$Z = (X_i + Y_i)\,(X_i/Y_i)$$

in which X_i is the larger mean density and Y_i is the smaller mean density of species in samples of a given size (here, 1/25 m^2) in the two years compared. This formulation of the index is a simplification of the discrepancy index already published (Sanders, 1978). When a species was absent in one of the years, we assigned one individual to that year, such that the mean density

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was one divided by the number of samples. At very low densities, a species absent in one of the years has a disproportionately large effect on the index; the replacement of null by one distorts the index. For each of stations 31, 9, 10, 20, and 35 we arranged the species in order of increasing discrepancy. We cumulated discrepancies and densities in that order and plotted the points on logarithmic paper. The line having a slope of +1 and a y-intercept of 0 represents the case in which the mean densities of the species are the same in the two years. The degree of departure from this line is a measure of the discrepancy between the mean densities of the two years.

We used three indices to evaluate the diversity of samples from stations 31, 9, 10, 20, and 35. One is the commonly used Shannon-Wiener information function:

$$H(s) = -\sum_{j} p_j \log p_j$$

in which s is the total number of species, and p_j is the observed proportion of individuals belonging to the jth species ($j = 1, 2, \ldots, s$). Another index of diversity is the evenness function;

$$V' = H(s)/H_{max}$$

in which H_{max} is log s. This index measures only the dominance component of diversity. The maximal value is 1.0, at which the individuals are distributed equally among species. The third index is Hurlbert's modification (1971) of the rarefaction method (Sanders, 1968), which predicts the number of species in a random sample without replacement, given a population N:

$$E\left[S_m \middle| \mathit{N}\right] = \sum_{i=1}^{k} 1 - \frac{\genfrac{}{}{0pt}{}{N-N_i}{m}}{\genfrac{}{}{0pt}{}{N}{m}}$$

in which N_i is the finite population of species i; N is $(N_1, N_2, \ldots, N_k)$, a vector representing the entire finite population; N is the total number of individuals in the finite population,

$$\sum_{i=1}^{k} N_i;$$

and S_m is the random variable denoting the number of species in a sample of size m (Smith and Grassle, 1977).

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There are many different indices for measuring either the variety of life in different habitats, or the relative "health" of an environment stressed by natural phenomena or pollutants. Among the more commonly used diversity indices are the Preston lognormal distribution (1948), the Margalef index (1957), the Fisher, Corbet, and Williams logarithmic series (1943), the Simpson diversity index (1949), the MacArthur broken-stick model (1957), the Shannon-Wiener information function (Shannon and Weaver, 1963), and the rarefaction method (Sanders, 1968, modified by Hurlbert, 1971).

The formulations of most indices involve assumptions about the way in which individuals are distributed among species in nature. The phenomenon measured is the closeness of agreement of a preconceived distribution with the natural one. The inherent danger is the mental ascendancy of the preconception over nature. A related difficulty is the unfortunate dependence of most diversity indices on size of sample, which for validity demands use of samples with identical numbers of individuals. The rarefaction method seeks to circumvent these two pitfalls: except at very low densities it is independent of sample size, and it does not make any assumptions about the distribution of individuals among species.

Most diversity indices have two components. One is dominance diversity, a measure of the evenness with which individuals are distributed among species, regardless of the number of species. The lower the degree of dominance, the more even this distribution, and the higher the diversity. The other component is species richness, a measure of the number of species in a sample. The greater the number of species, the greater the diversity (Whittaker, 1965). The relative contributions to these two components to the diversity value differ from one index to another.

The Shannon-Wiener information function reflects primarily the evenness of the five or six most abundant species, Smith, Grassle, and Kravitz (1979) show that the information function is essentially equal to the expected number of species in a random sample of 10 from a population, and equivalent to Hurlbert rarefaction at the level of 10 individuals. At this low density only the more abundant species are likely to be represented.

To determine the relative contributions of species richness and evenness to diversity at stations 31, 9, 10, 20, and 35, we ranked samples by diversity and by evenness from most diverse or even (1) to least diverse or even (71 in the analysis of the whole fauna, 70 in that of the fauna without the one most dominant species). Values of diversity were derived from the rarefaction curves, and are the inverse of the number of animals in 20 species. Values of evenness were calculated from the evenness function. The most diverse and most even fauna would have one animal for each of the 20 species. We used only those samples with at least 20 species. We estimated the contribution of species richness from the relative positions of the curves for evenness and species richness.

We used an agglomerative technique (Williams, 1971) to determine degree of faunal similarity among the various stations. In an agglomerative technique the most similar samples cluster most closely and first, less similar samples cluster less closely, and least similar samples most distantly and

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last. We used NESS, the Normalized Expected Species Shared, to assess faunal similarity (Grassle and Smith, 1976). This measure is sensitive to less common species, and is used to detect spatial and temporal relationships among samples on the basis of their species composition and on the number of these species shared among random subsamples of fixed size from each collection. We used a subsample size of 50, at which both rare and common species contribute to the measure. We included in the analysis only those samples with at least 100 animals. In some cases, the whole fauna of a sample had the required number of animals, but the fauna without the one most dominant species had too few animals; those sample were omitted from the analysis. Because it handles no more than 3000 entries, each species of each sample a separate entry, the program could analyze only three offshore stations at a time. Ideally, samples from an undisturbed station will cluster closely together and by season. The fauna at such a station undergoes seasonal oscillations and varies little from year to year. Samples from a station at which the fauna has been severely disturbed will cluster in temporal sequence, and more closely with the passage of time. At such a station the fauna undergoes successional changes, and varies from one year to the next.

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SECTION 4

RESULTS

Sediments

At eight of the nine stations analyzed sediments were muddy sands with small amounts of gravel and shell debris. At station 31 the sediment was sandy mud. Sediments at seven stations were studied in enough detail to provide some granulometric information. Secular changes were slight or absent. Figures 4 and 5 summarize the results.

At station IV the bottom was fine sand with an average value of the median of 2.40 ϕ (0.16 mm). Clastic gravel was absent. Some samples appear to have had a minor mode in the mud class. The sands became finer with time, and were usually moderately well sorted and nearly symmetrical. In April, 1971, the sediment was poorly sorted and strongly fine skewed. The sediments seem to have been more strongly fine skewed in the early spring and late summer than in the late spring.

At station II sediments were fine and medium sands, coarser than those at station IV. Variation in the median size was not very great, 1.89 to 2.31 ϕ (0.27 to 0.21 mm). These sands were about as well sorted as those at station IV, but they seem to have been muddier. In March,1971, as in the next month at station IV, the sediment was finer, more poorly sorted, and more fine skewed than usual. Only one sample was clearly bimodal, one was unimodal, and the other five appear to have had a minor mode in the mud class. As at station IV, the sediments were granulometrically variable from sample to sample.

All seventeen samples from station 31 were sandy silts without clastic gravel. The proportion of sand was variable (12.5 to 48.0%). The average sample was about 20% sand, 70% silt, and 10% clay. The four sandiest samples were taken in late spring (May, 1970; June,1971) and in winter (December, 1971; March, 1972). Further data are wanting.

The six samples from station 30 which were analyzed appeared most similar to the gravelly sands at stations 5 and 20.

Most sediments at stations 9 and 10 were very fine sands, slightly finer at station 10. All samples were nearly symmetrical; those at station 9 were usually slightly coarse skewed, those at station 10 slightly fine skewed. Small amounts of gravel occurred at station 9 but not at station 10, where the sediment was always unimodal. Sorting was better at station 10. The sand at station 10 appears to have been very well sorted and devoid of mud in

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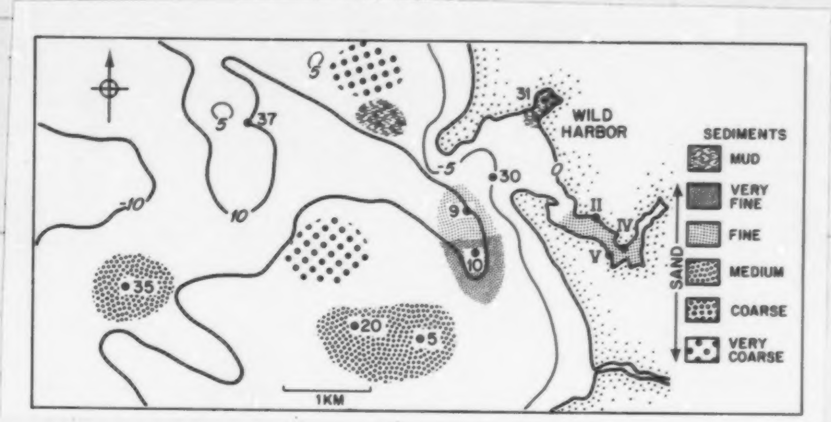

Figure 4. Distribution of sediments in intensively sampled area, with additonal data from Hough (1940) and Moore (1963).

September , 1970, although the work sheet suggests that these appearances resulted from procedural error. At station 9 the sediment became slightly coarser with time; at station 10 the sediment seems not to have shown temporal trends. The sediments at station 10 were less variable than those of any other station, even those of station 9 which they most closely resembled.

The sediments at stations 5 and 20 were alike, most of them slightly gravelly medium sands moderately well to well sorted and symmetrical. Mud was minor. The sands at station 20 were usually coarser than those at station 5. At both stations sediments were coarser in the late spring and early summer, and finer in mid- and late summer. Two samples from station 5 were unimodal very fine sands, similar to those at stations 9 and 10 (Figure 5).

Sediments at station 35 varied from sample to sample in all aspects. All had a minor mode in the gravel class. The median size, medium and fine sand, was about as variable as those at stations 9 and II. Most samples were moderately well to poorly sorted, and on the whole more poorly sorted than samples from other stations. The proportion of mud was higher here than at other stations except station 31. Skewness toward the fines seems to have been greatest in late autumn and winter, when sorting was poorest. The great variability suggests that station 35 was on a facies boundary. Because all samples were taken in the same way, and because the offshore stations were accurately relocated, it seems unlikely that the variability resulted from procedural error.

Only a few samples from control stations were analyzed. The one sample from Sippewissett Marsh most closely resembled sediments from intertidal stations II and IV, but was sandier. The gravelly slightly muddy sands of stations 70 and 80 were most similar to sediments at station 5. The muddy sand at station 90 was like that of station 9; the sandy muds of this control station resembled the sandier sediments at station 31.

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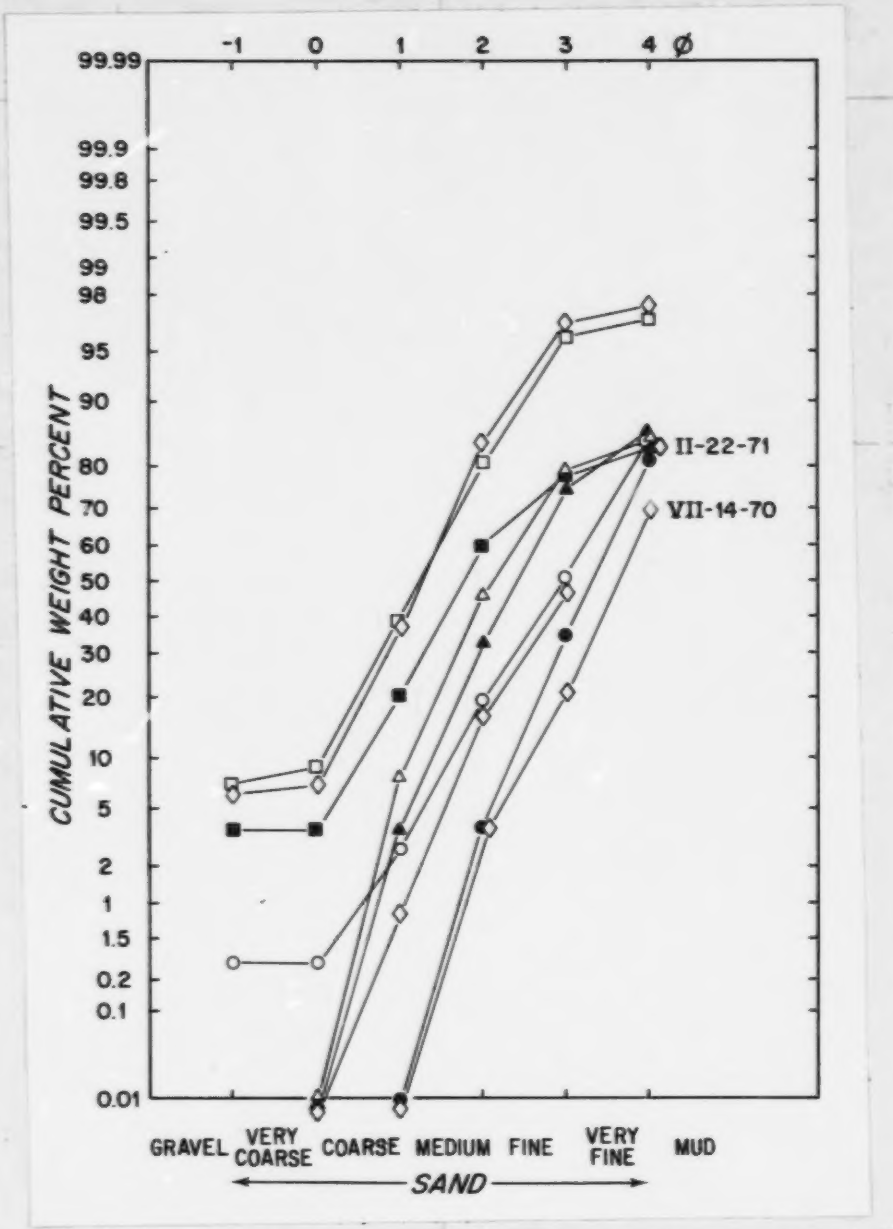

Figure 5. Cumulative curves for average samples at stations 5, 20, 35, II, IV, 9, and 10, and for the two unusually fine sediments from station 5.

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Hydrocarbons

The oil spilled by the FLORIDA contained normal alkanes which ranged from *n*-decane to *n*-docosane (C_{10} to C_{22}), with a maximum around C_{14} to C_{15}. Isomeric and homologous hydrocarbons, mostly aromatics and cycloalkanes, were so numerous that their boiling points overlapped, a phenomenon expressed in the gas chromatograms as a broad unresolved envelope. Above this unresolved background were more or less defined peaks of homologous series of straight and branched alkanes. The *n*-C_{17}/pristane value for the undegraded fuel oil was 1.67.

The oil which polluted Wild Harbor River and adjacent offshore areas was that spilled by the barge FLORIDA on September 16, 1969. The pristane/phytane value established that all samples but one of petroleum hydrocarbons in the West Falmouth area were derived from this oil. Petroleum hydrocarbons from another source occurred at station 36 in November, 1970, and a large concentration of biogenic hydrocarbons appeared at station 10 in June, 1971. Presence of hydrocarbons having the boiling point range of the #2 fuel oil from the FLORIDA, 170-370°C, showed that this oil became incorporated into the sediments of Wild Harbor River and adjacent parts of Buzzards Bay.

There was an onshore-offshore gradient in concentration of the #2 fuel oil. Concentrations were greatest at station 31 (Table 2), which remained heavily polluted with residues of this oil for at least two years (Blumer and Sass, 1972a, b,c). The concentration of relatively undegraded #2 fuel oil was particularly high in the late winter of 1970. Sediments at the three intertidal stations, II, IV, and V, also contained 1.4 to 19 times the maximal normal environmental background, 10 mg/100 g dry sediment, during the two years after the spill. Among the offshore stations, only stations 9 and 10 had quantities of hydrocarbons clearly in excess of the normal environmental background, and only in the first eleven months. Concentrations were intermediate or low at stations 7, 30, and 20; the mean hydrocarbon concentrations at stations 20, 35, and 37 were essentially unchanged in the first two years after the spill.

Degradation of the #2 fuel oil was slow, especially at the most heavily polluted stations, and the different modes of degradation proceeded at different rates along the gradient of pollution. At stations II, IV, V, and 31 the boiling point distribution of the hydrocarbons was very similar to that of the fresh oil for at least two years after the spill. The *n*-C_{17}/pristane and pristane/phytane values at station 31 decreased very little for several months after the spill (Figures 6, 7). At all four of these stations solution was retarded, and short-term toxicity did not decrease. Solution and reduction of short-term toxicity were slightly more rapid at stations 7, 9, and 10 than at the four most heavily oiled stations. Retreat of the boiling point envelope was slow for hydrocarbons from stations 7, 30, 10, and 20; hydrocarbons in the C_{13}-C_{14} range were still detectable two years after the spill. Less-degraded fuel oil arrived at station 10 in August, 1971, as indicated by the reversal of the values of *n*-C_{17}/pristane and pristane/phytane (Figures 6, 7). At stations 7 and 20 (Figure 6) the *n*-C_{17}/pristane values were much lower than those at station 31. Biodegradation progressed relatively rapidly at stations 20, 35, and 37, and was six to eight months in advance

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TABLE 2. HYDROCARBON CONTENT OF SEDIMENTS FROM BUZZARDS BAY, IN MG HYDROCARBONS IN 100 G DRY SEDIMENT. ALL VALUES ROUNDED TO TWO SIGNIFICANT FIGURES. AFTER BLUMER AND SASS, 1972a

	STATIONS											
Date	5	7	9	10	20	31	35	36	37	II	IV	V
9/69		6.9			3.9	55				59	45	
10/69		19			4.4	110	4.6				55	
11/69		14	24	15	2.4	110	5.3	2.0	4.0			
12/69		12		25	4.5	110	6.0			76	150	180
1/70								6.2	4.4			
2/70									3.8	51	120	15
3/70						1240			3.5			
4/70		4.8		28	6.2	450	4.2	2.1	5.9		140	190
5/70		6.5		25	3.5	210	4.9	7.0	7.0	52	40	77
6/70		4.5		18	2.4	400	5.3	2.9	6.7	44	23	78
7/70		7.4		14	2.5	240	6.4	4.3	5.7	75	150	40
8/70				9.2		120		2.9	4.1			
9/70		2.6	5.9	9.4	4.9	210	7.9	6.1	4.2			
10/70										63	81	56
11/70		4.3		9.8	3.1	300	11	6.8	8.5	22	18	45
12/70		5.0	11	8.0	3.4	190				45	35	55
1/71						160	5.4	4.0	5.0			
2/71		5.4	6.7	9.4	3.4		3.3	3.1	7.3			
3/71						200				39	34	29
4/71	1.8	3.5	7.7	5.6	5.2	200				37	86	
5/71												

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TABLE 2 (continued)

Date	STATIONS 5	7	9	10	20	31	35	36	37	II	IV	V
6/71		4.5	5.6	8.8	3.6	230	4.4	4.2	4.6	15	19	40
7/71	3.3	1.1		4.6	2.3			6.0		34	27	16
8/71	3.7	1.3	6.1	5.4	2.0	130	3.5		5.6	14	40	32
9/71		3.0		8.4	5.4	130	4.5	3.9	4.6			
10/71										15	34	19

TABLE 3. HYDROCARBON CONTENT OF SEDIMENTS FROM BUZZARDS BAY, IN MG HDYROCARBONS IN 100 G WET SEDIMENT. AFTER MICHAEL, VANRAALTE, & BROWN, 1975. ASTERISKS INDICATE THAT GAS CHROMATOGRAPHIC ANALYSES WERE ALSO PERFORMED.

Date	STATIONS 9	10	20	31	35	II	IV	V	Sippewissett
4/73	15*	7	3*	507	8	55	43	59	10
7/73	21								
9/73				609					
11/73	3*	3	2	66	6	23	39	46	9
5/74	9	8	3	138*	7	22*	34*	51*	11*
6/74				350					

* Gas chromatographic analysis also performed.

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of that at station 31. Such different rates of biodegradation indicate delayed bacterial attack in heavily oiled sediments. The fuel oil which first arrived at stations 20 and 35 was already somewhat altered and more degraded than that contemporaneously at the more heavily polluted inshore stations. As the oil moved seaward, the very toxic benzenes and naphthalenes, which constitute the largest proportion of the aromatics in fuel oil, dissolved in the sea water. At stations 20, 35, 36, and 37, solution and reduction of the short-term toxicity of the benzene and naphthalene aromatics were relatively rapid. Through September, 1970, oil in the sediments at station 36 showed the characteristics of that spilled in September, 1969.

Michael, Van Raalte, and Brown (1975) studied the further weathering of the fuel oil from the FLORIDA in the fifteen months from April, 1973, through June, 1974 (Table 3). Concentrations of hydrocarbons derived from this oil were two to six times the normal background at stations II, IV, and V. At station 31 hydrocarbon concentrations were six to sixty times the normal level; these hydrocarbons were derived from the #2 fuel oil, not from the fuel of motorboats. Hydrocarbon concentrations at station 9 were at times somewhat above the normal background, but they were at or below that level at station 10. Weathered #2 fuel oil occurred at stations 9 and 10 as late as July, 1973, 46 months after the spill. Biogenic hydrocarbons were present at these two nearshore stations in November, 1973, and May, 1974. Number two fuel oil was undetectable by gas chromatography at stations 20 and 35 and in Sippewissett Marsh in April, 1973, and hydrocarbon concentrations at these three sites were at or below the normal background level.

Oil continued to move in pulses from the more heavily polluted areas seaward into Buzzards Bay (Figures 8-12) for several years after the spill. It is likely that oil incorporated in the sediments of the shallower reaches of Wild Harbor River was liberated by storms which roiled the bottom.

Burns and Teal (1971) studied by gas chromatogram the sediments, algae, marsh plants, fish, and gulls from Wild Harbor River and from unpolluted Sippewissett Marsh and Weepecket Islands in 1970 and 1971. Residues of #2 fuel oil were in all sedimentary and biologic samples from Wild Harbor River; all samples but one from Sippewissett Marsh were free of oil. The exception was the eel, *Anguilla rostrata*, a highly mobile animal which probably became contaminated with fresh fuel oil in Buzzards Bay. In Wild Harbor River, marsh grasses, *Spartina patens* and *S. alterniflora*, were dead at heavily oiled sites, but alive at lightly oiled ones during January, 1971. Residues in animals were more degraded than those in plants. Muscle and brain tissue of a juvenile herring gull, an animal at an upper trophic level, taken while feeding in Wild Harbor River one month after the spill, contained considerable quantities of hydrocarbons derived from the #2 fuel oil. An adult herring gull taken in June, 1971, from the colony on the Weepecket Islands (Figure 2) contained pollutant hydrocarbons from some source other than the #2 fuel oil from the FLORIDA.

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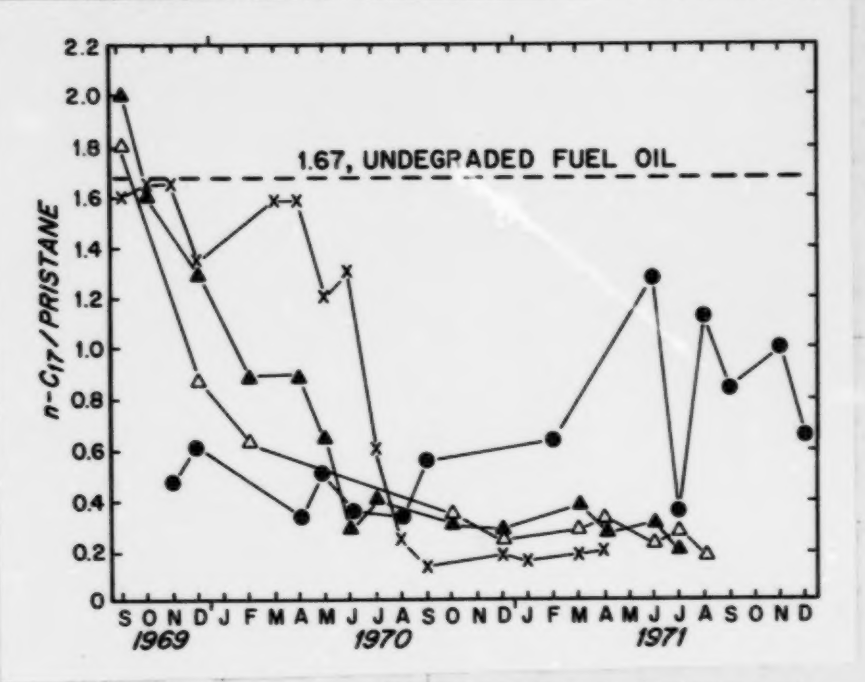

Figure 6. Changes in the value of n-C_{17}/pristane at stations 31, II, IV, and 10.

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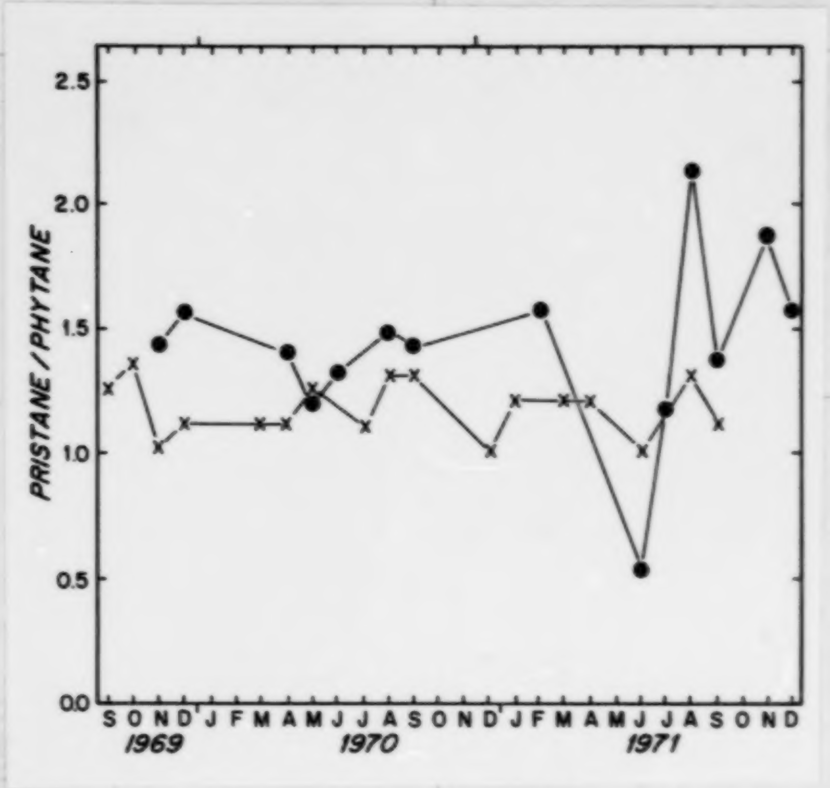

Figure 7. Changes in the value of pristane/phytane at stations 31 and 10.

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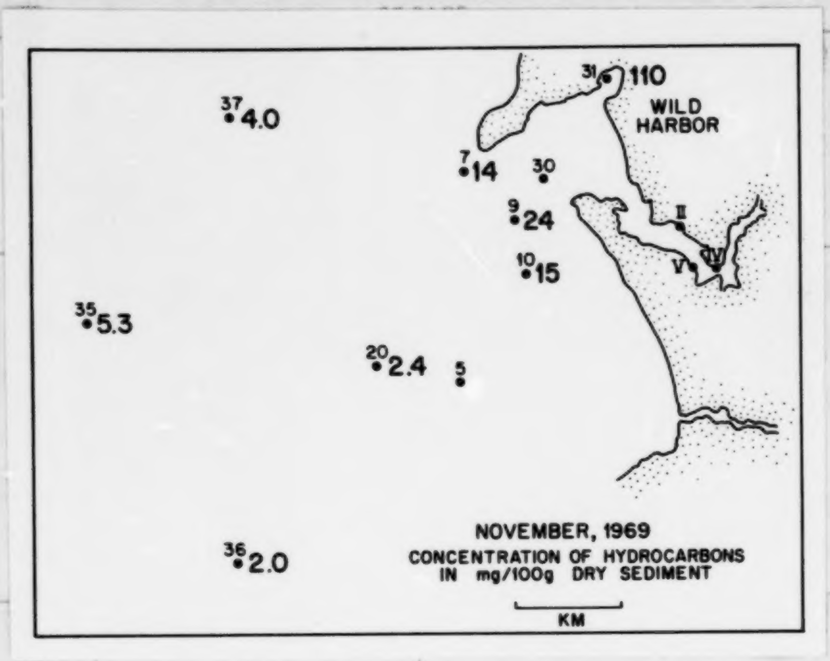
31 110
WILD HARBOR
37 4.0
7 14
30
9 24
II
IV
V
10 15
35 5.3
20 2.4
5
36 2.0
NOVEMBER, 1969
CONCENTRATION OF HYDROCARBONS IN mg/100g DRY SEDIMENT
KM

Figure 8. Concentrations of hydrocarbons during November, 1969, in Wild Harbor River and adjacent offshore areas, two months after the spill.

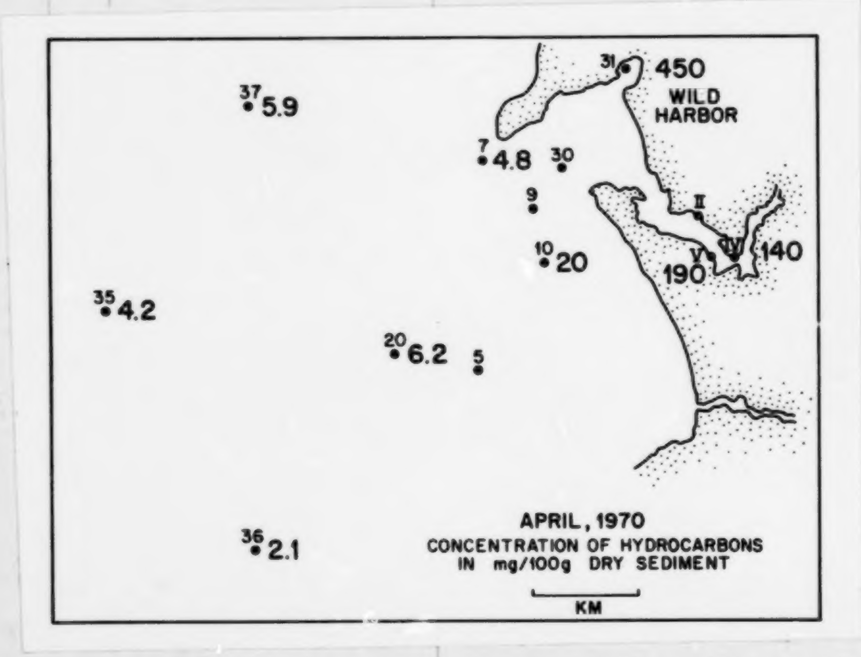
31 450
WILD HARBOR
37 5.9
7 4.8
30
9
II
IV 140
V 190
10 20
35 4.2
20 6.2
5
36 2.1
APRIL, 1970
CONCENTRATION OF HYDROCARBONS IN mg/100g DRY SEDIMENT
KM

Figure 9. Concentrations of hydrocarbons during April, 1970, in Wild Harbor River and adjacent offshore areas. Oil was spreading seaward from the river.

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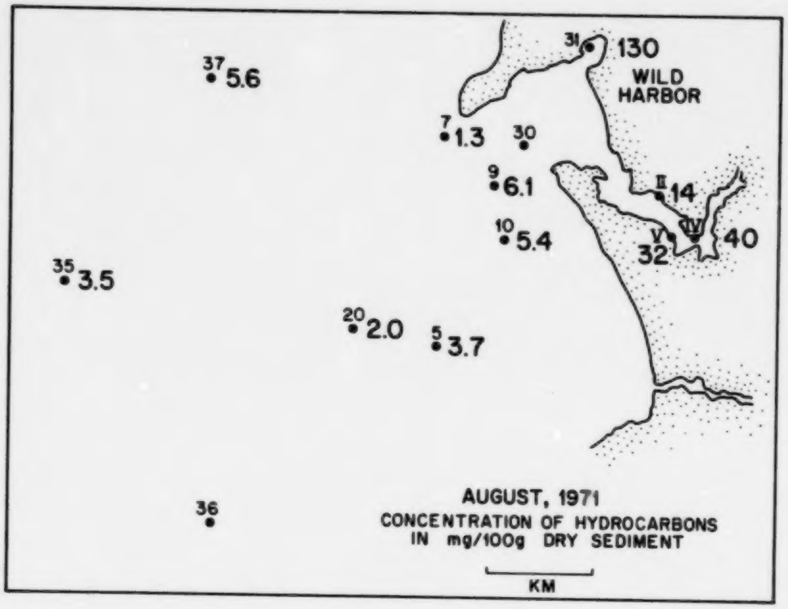
37 5.6
31 130
WILD HARBOR
7 1.3
30
9 6.1
II 14
10 5.4
V 32
40
35 3.5
20 2.0
5 3.7
36
AUGUST, 1971
CONCENTRATION OF HYDROCARBONS IN mg/100g DRY SEDIMENT
KM

Figure 10. Concentrations of hydrocarbons during August, 1971 in Wild Harbor River and adjacent offshore areas. During that month less-degraded oil spread seaward to station 10.

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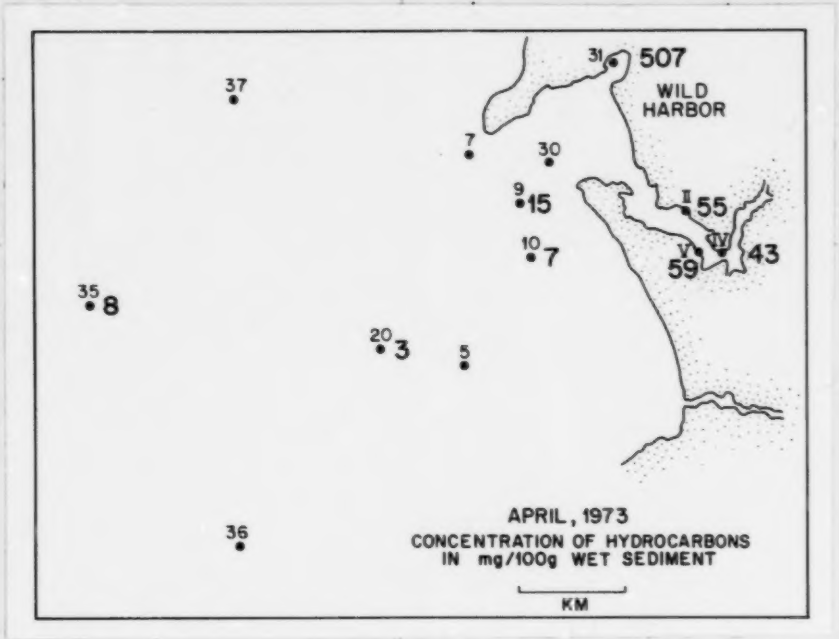
31
507
WILD HARBOR
37
7
30
9
15
I
55
10
7
IV
V
59
43
35
8
20
3
5
36
APRIL, 1973
CONCENTRATION OF HYDROCARBONS IN mg/100g WET SEDIMENT
KM

Figure 11. Concentrations of hydrocarbons during April, 1973, in Wild Harbor River and adjacent offshore areas. During this period, the concentrations rose in the river and harbor.

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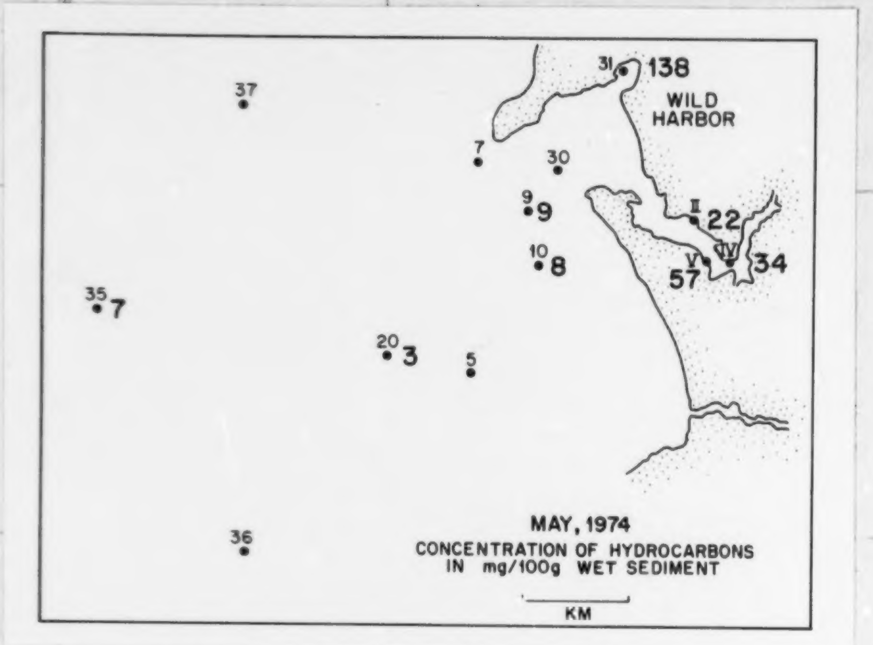

Figure 12. Concentrations of hydrocarbons in Wild Harbor River and adjacent offshore areas in May 1974. The concentrations in the river and the harbor still exceeded the normal environmental background level.

Densities and Numbers of Species

Within ten days after the spill, numbers of species and animals at heavily oiled stations 31, II, and probably IV dropped abruptly to very low levels (Figures 13-16). Mass mortality was greatest at station II. At station 31 the number of species only three days after the spill was almost as high as that of lightly oiled stations offshore in the first post-spill year. The bloom of *Capitella* began almost immediately at the biologically denuded intertidal stations, but was delayed a month or two at most heavily oiled station 31 (Figures 17-19). Five other species also became abundant at this subtidal station in the last months of 1969. In the winter of 1969-70 much of the fauna, including *Capitella*, died at the intertidal stations; ice may have caused this mass death. During the spring, the number of species was low at all three stations, and oscillated at station II. Density of the whole fauna rose sharply during the seasonof recruitment, which seems to have begun in June, a few weeks earlier than at offshore stations. *Capitella* constituted the vast majority of animals at stations II and IV, and at station 31 formed an almost unispecific culture. During the late summer and early autumn of 1970, *Capitella* crashed at all three stations, and remained relatively uncommon for the next two years, even in the later recruitment seasons.

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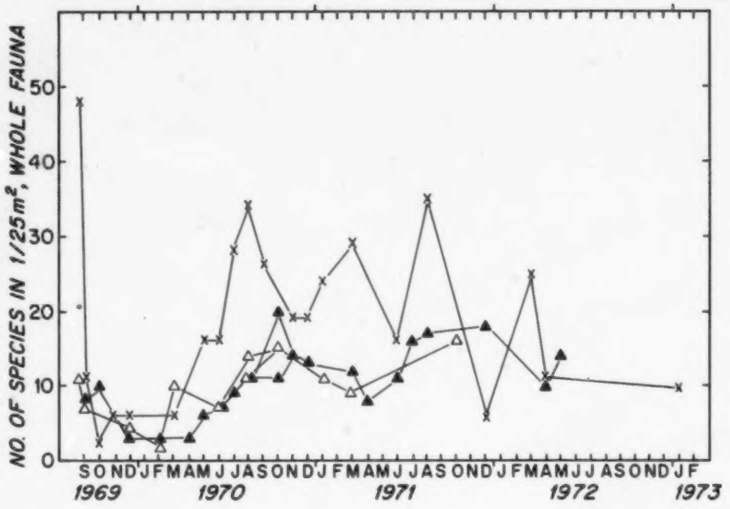

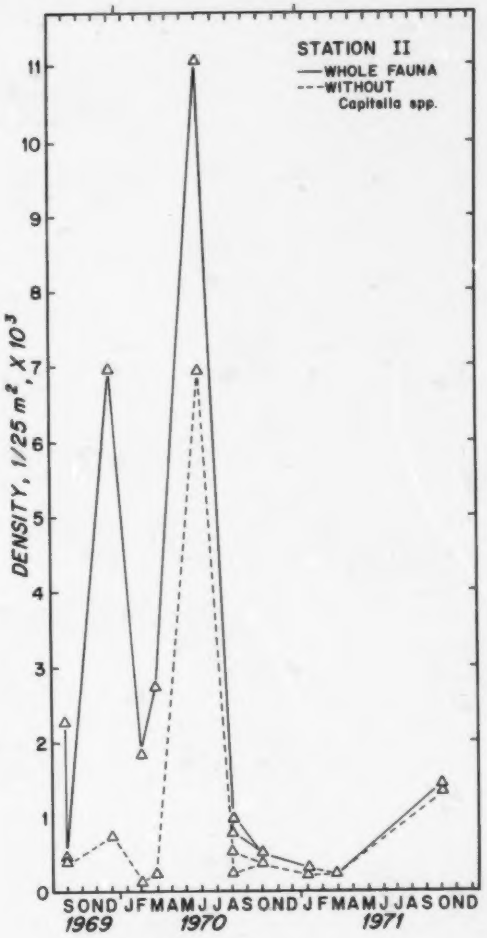

Figure 13. Number of species in 1/25 m^2 at station 31, and in 1/128 m^2 at stations II and IV, in Wild Harbor River.

Figure 14. Density of the fauna with and without *Capitella*, in 1/25 m^2 , at intertidal station II. Bifurcation of line indicates replicate samples. ↠

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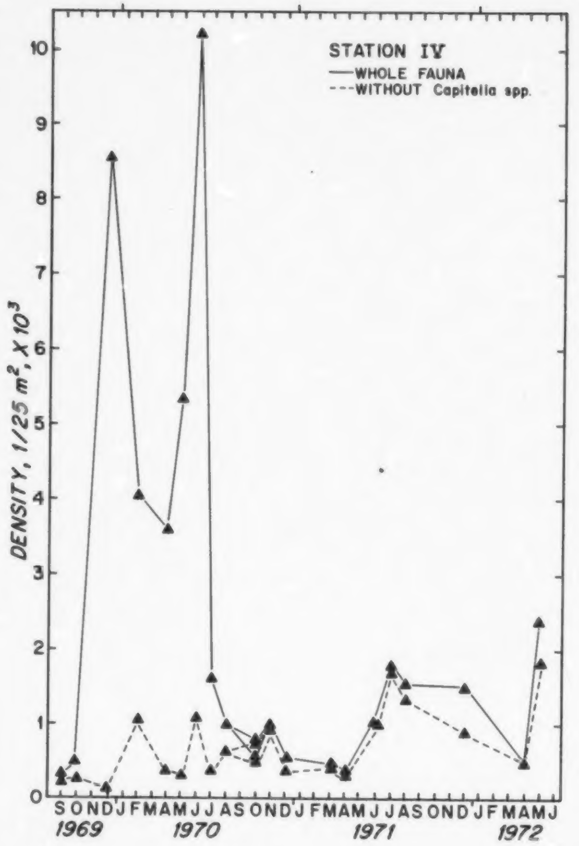

Figure 15. Density of the fauna with and without *Capitella*, in 1/25 m^2, at intertidal station IV. Bifurcation of line indicates replicate samples.

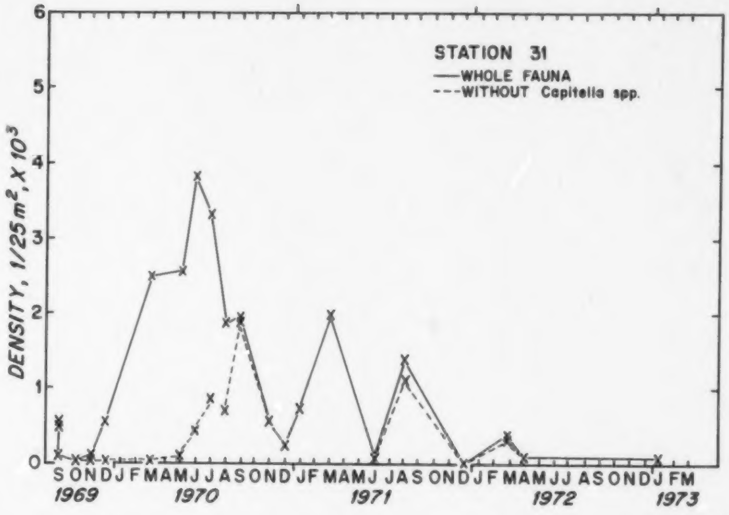

Figure 16. Density of the fauna with and without *Capitella*, in 1/25 m^2, at subtidal station 31. After August, 1970, *Capitella* was minor in every sample.

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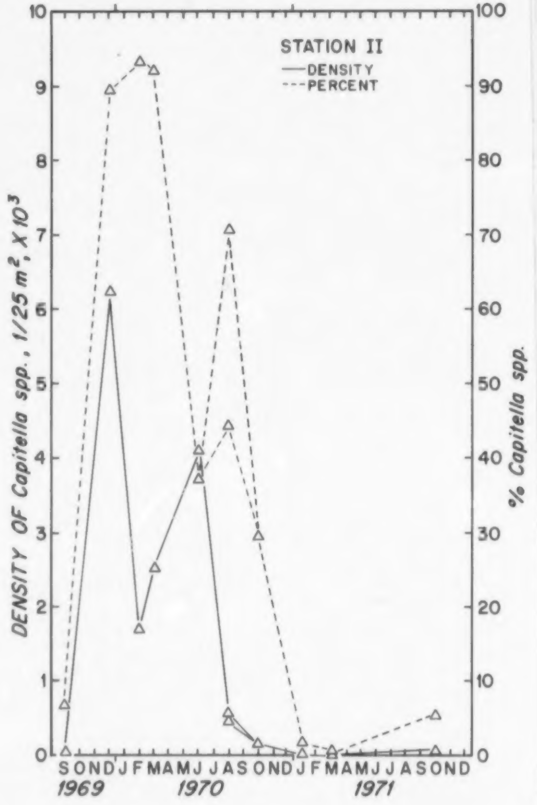

Figure 17. Density of *Capitella* at station II, in 1/25 m^2, and percent of whole fauna comprised by this polychaete.

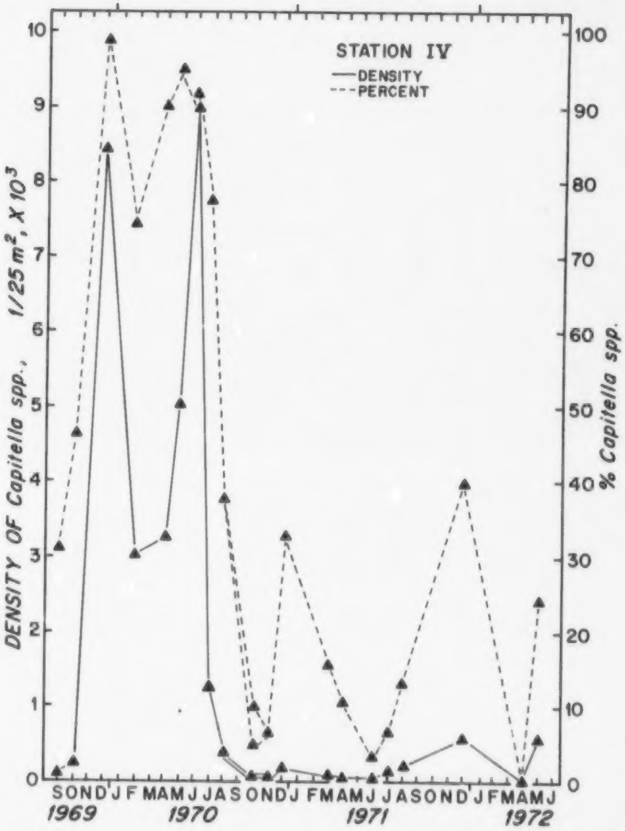

Figure 18. Density of *Capitella* at station IV, in 1/25 m^2, and percent of the fauna comprised by this polychaete.

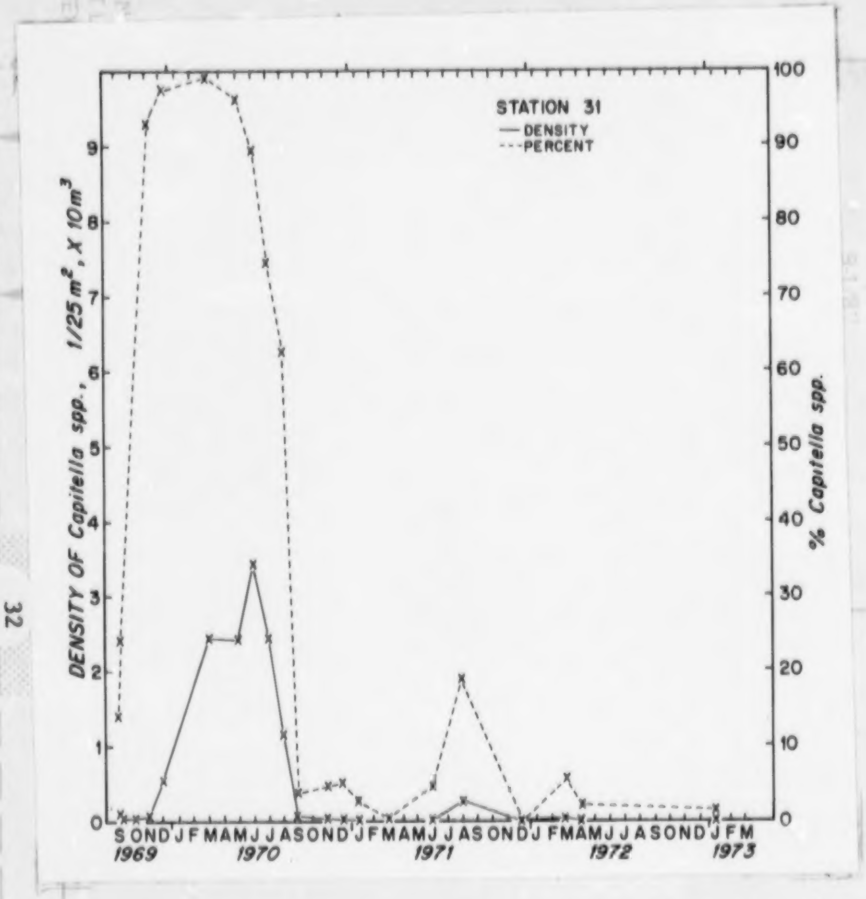

Figure 19. Density of *Capitella* at station 31, in 1/25 m^2, and percent of whole fauna comprised by this polychaete.

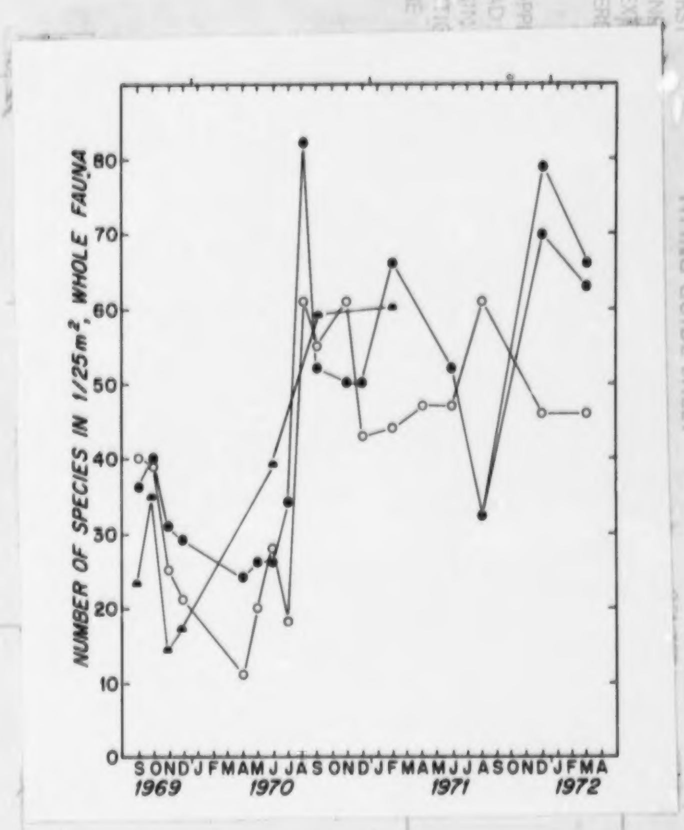

Figure 20. Number of species in 1/25 m^2, at nearshore subtidal stations 30, 9, and 10.

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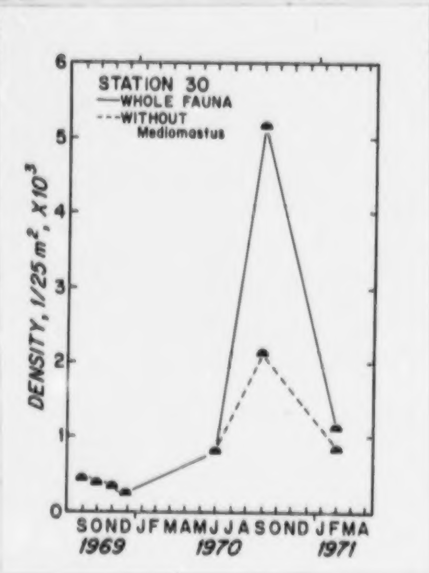

Figure 21. Density of the fauna with and without *Mediomastus* in 1/25 m^2, at station 30. *Mediomastus* was minor before June, 1970.

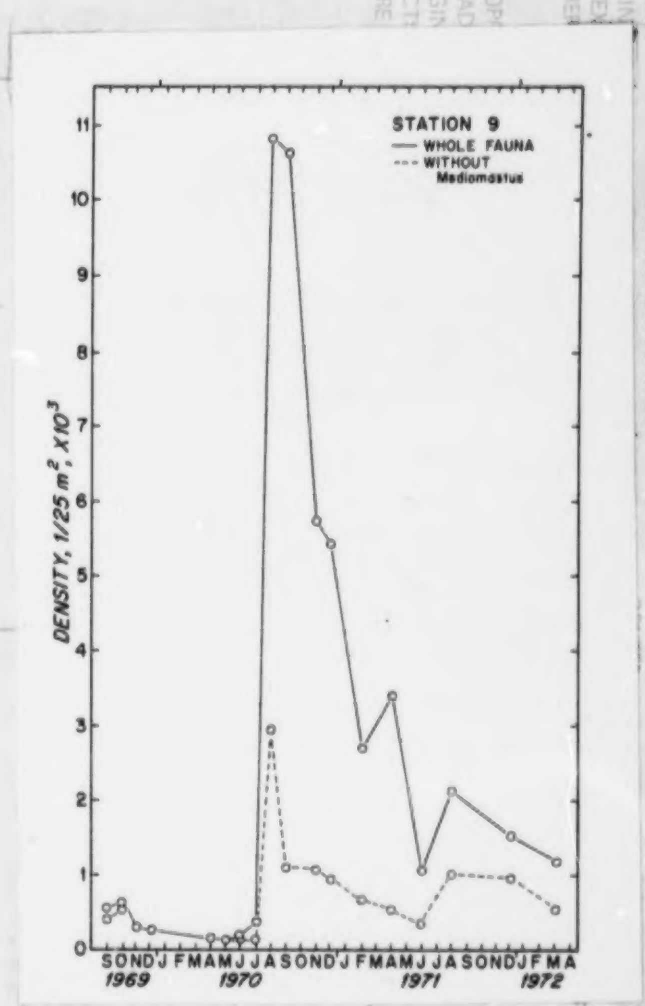

Figure 22. Density of the fauna with and without *Mediomastus* in 1/25 m^2, at station 9.

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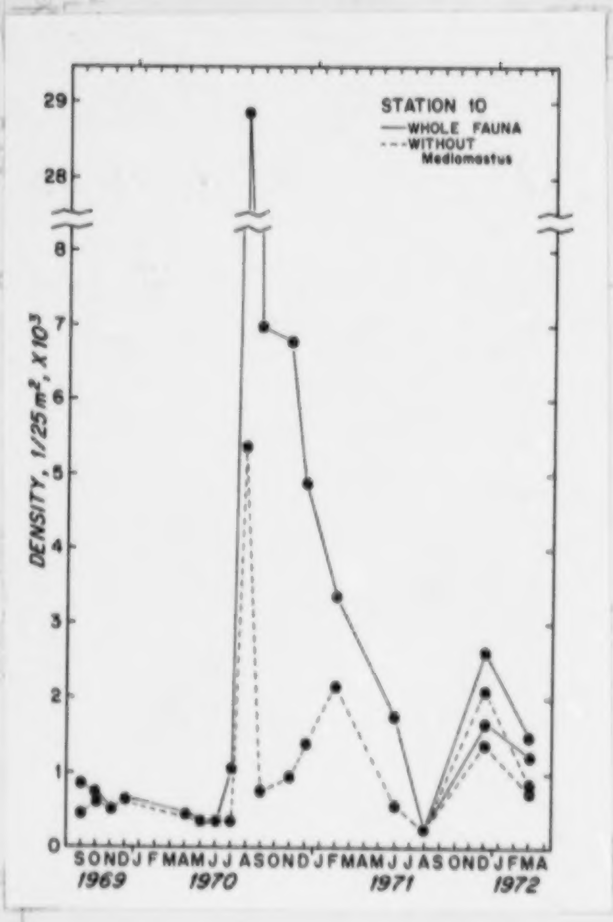

Figure 23. Density of the fauna with and without *Mediomastus* in 1/25 m^2, at station 10. Bifurcation of lines indicates replicate samples.

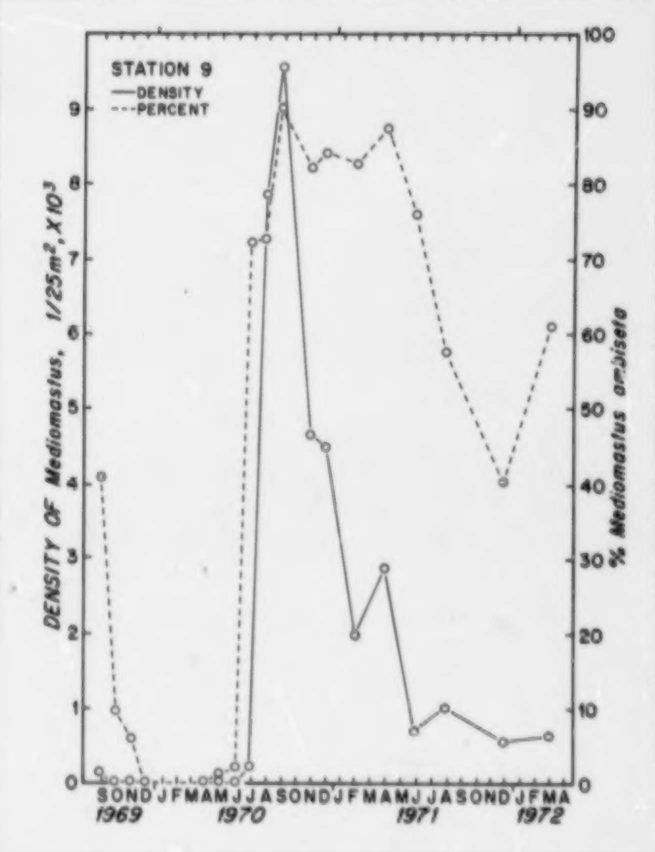

Figure 24. Density of *Mediomastus* in 1/25 m^2, at station 9, and percent of whole fauna comprised by this polychaete.

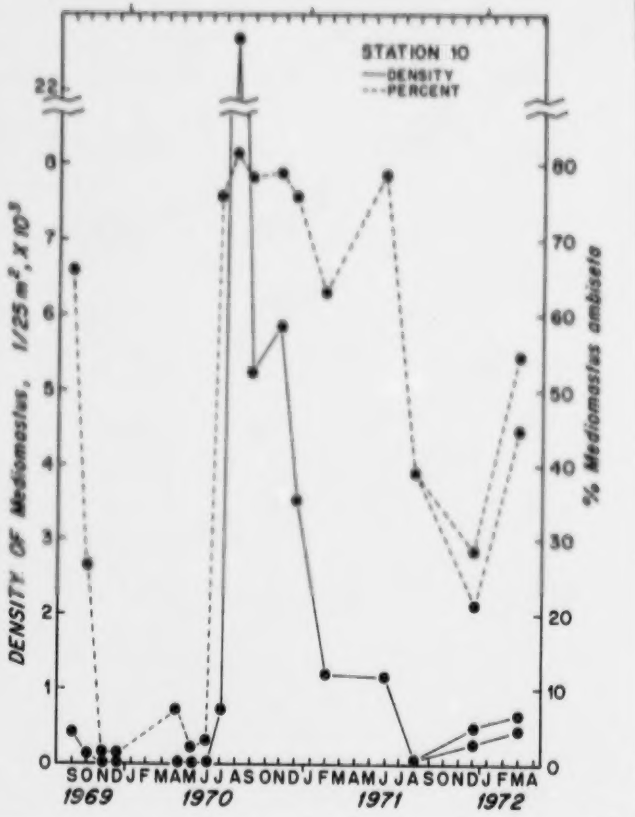

Figure 25. Density of *Mediomastus* in 1/25 m^2 at station 10, percent of whole fauna comprised by this polychaete. Bifurcation of lines indicates replicate samples.

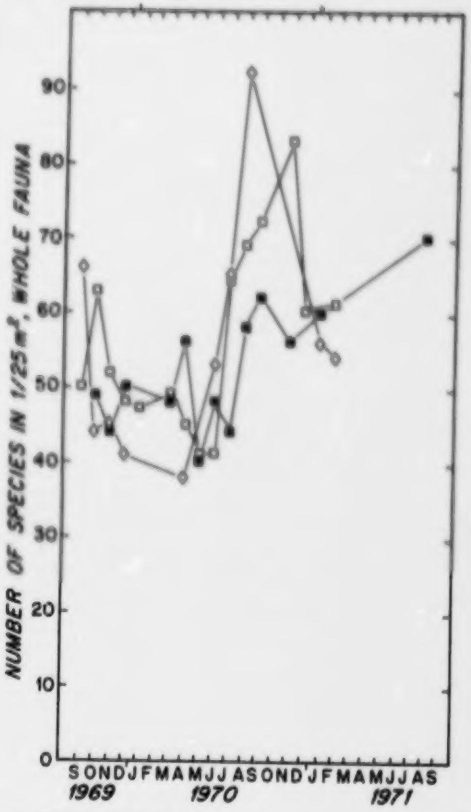

Figure 26. Number of species in 1/25 m^2 at subtidal stations 5, 20, and 35 farther offshore.

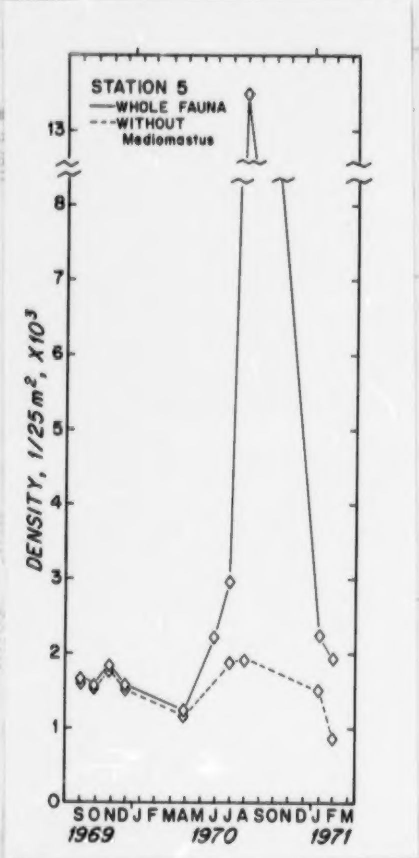

Figure. 27. Density of fauna with and without *Mediomastus* in 1/25 m^2, station 5.

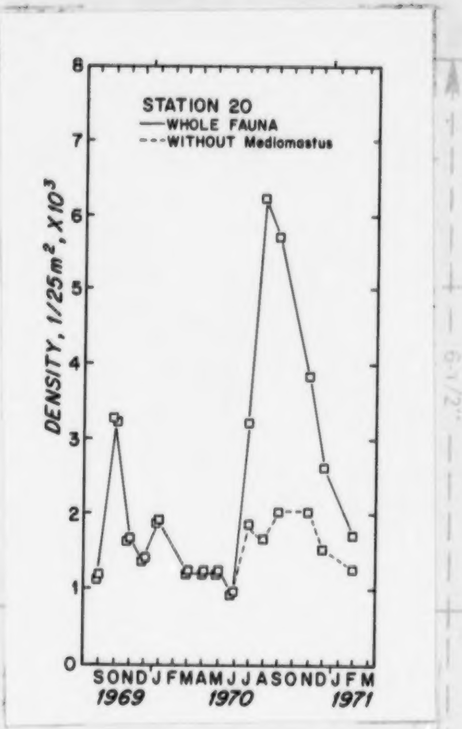

Figure 28. Density of fauna with and without *Mediomastus* in 1/25 m^2, station 20.

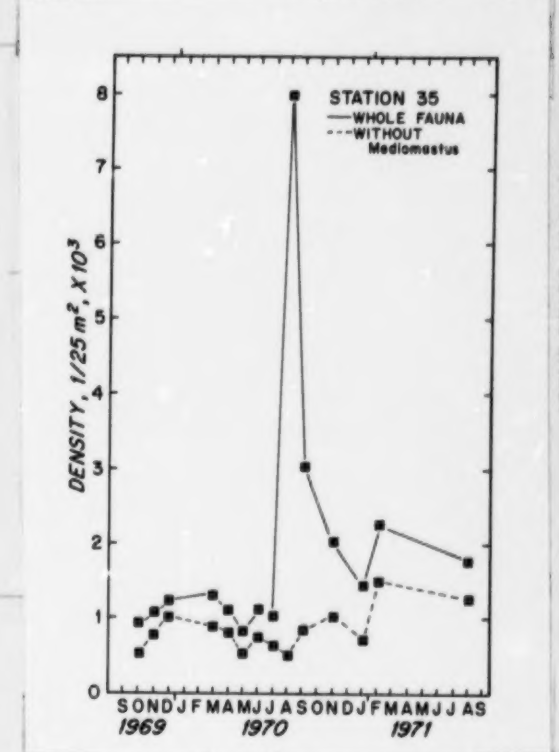

Figure 29. Density of fauna with and without *Mediomastus* in 1/25 m^2, station 35.

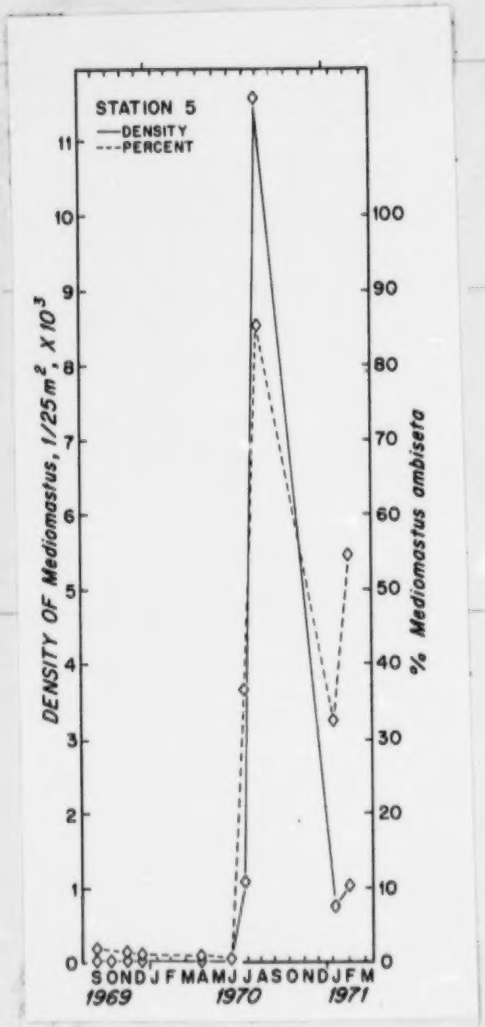

Figure 30. Density of *Mediomastus* in 1/25 m^2, at station 5, and percent of whole fauna comprised by the polychaete.

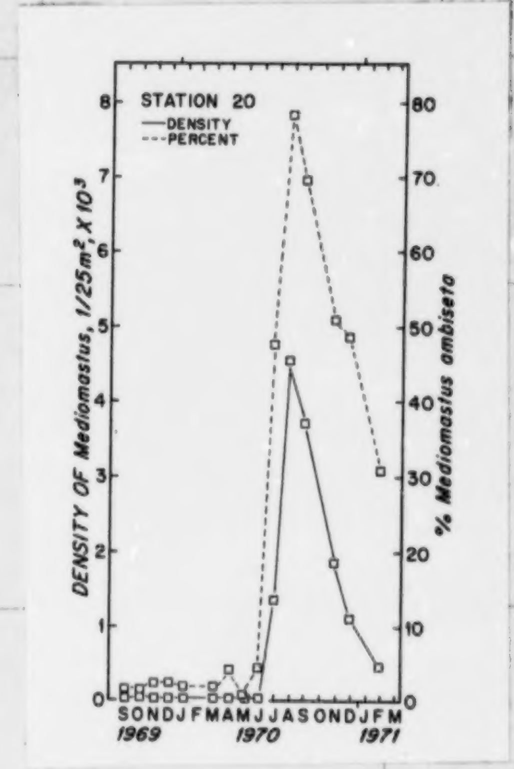

Figure 31. Density of *Mediomastus* in $1/25m^2$ at station 20, and percent of whole fauna comprised by this polychaete.

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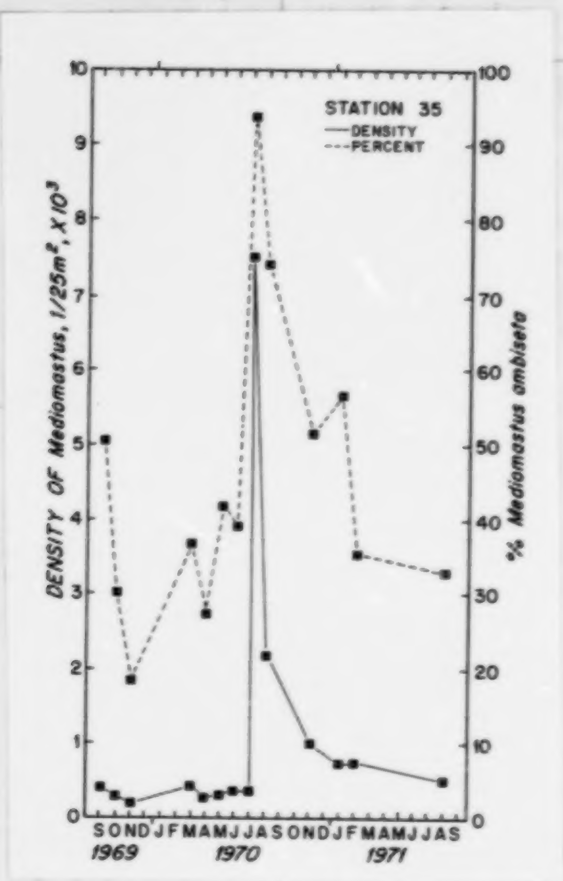

Figure 32. Density of *Mediomastus* in $1/25\ m^2$ at station 35, and percent of whole fauna comprised by this polychaete.

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Numbers of species rose at stations II and IV during the second and third years. This number fluctuated widely at station 31, and by the middle of the fourth year had not risen to the level found three days after the spill. Density fluctuated at stations 31 and IV, and by the end of two or more years had not risen to the earliest levels.

Within a few days after the spill fairly large quantities of less-degraded #2 fuel oil spread to the sediments of offshore stations 30, 9, and 10. The fauna behaved the same way at all of these stations, even though the sediments at station 30 were apparently much coarser than those at the other two stations. Density and number of species (Figures 20-23) declined sharply in the first eleven months to low levels, but not so low as those at the intertidal and subtidal river stations. Opportunists failed to colonize the bottom in this first span of time. During the first recruitment season after the spill, July and August, 1970, densities and numbers of species rose greatly, and *Mediomastus ambiseta* became abundant and dominant (Figures 24, 25). At that time *Macoma tenta* was common at stations 9 and 10. At these two stations the fauna consisted almost entirely of juveniles. Within the next month numbers of species and animals, including *Mediomastus,* declined rapidly as a result of crowding. This bloom and decline was greatest at station 10. The number of species thereafter was intermediate to fairly high, and fluctuated widely at station 10. In August, 1971, the second season of recruitment after the spill, numbers of species and animals rose somewhat at station 9, and *Mediomastus* again became abundant and dominant. This polychaete decreased in dominance in the third year at station 9. During the second season of recruitment, a new infusion of less-degraded #2 fuel oil prevented the usual surge of numbers at station 10, although *Capitella* became fairly abundant in August, 1971. Although densities at stations 9 and 10 oscillated somewhat during the second and third years, numbers of both animals and species were considerably higher than in the first eleven months after the spill.

At offshore stations 5, 20, and 35, where concentrations of hydrocarbons were almost always within the range of the normal background, numbers of animals and species were generally higher at any one time than those of other stations (Figures 26-29). Of these three stations, station 35 had the lowest densities, which were still higher than those at stations 9 and 10. Reduction in numbers of species and animals in the first eleven months was less severe at stations 5, 20, and 35 than elsewhere. As at stations 9, 10, and 30, *Mediomastus* first became abundant and dominant in the first season of recruitment (Figures 30-32), July and August, 1970, when it constituted the majority of the benthic fauna. Aside from *Mediomastus*, density increased only slightly during this season, but numbers of species equaled or exceeded the numbers found shortly after the spill, before effects of the oil had become evident. The increase in density in August, 1970, was generally less marked at these offshore stations than at station 9 and 10. During the winter of 1970-71, density and number of species decreased at all three stations, but rebounded in the spring and summer at station 35, the only one of these stations for which appropriate information exists. Density and numbers of species did not oscillate at these three distant offshore stations as they did at the stations nearer shore and in the river. By the end of the period studied, number of species had declined below the initial level at station 5, but had increased above that level at stations 20 and 35.

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Differential Mortality

One-way analysis of variance and covariance of densities of *Mediomastus* at stations 9, 10, 20, and 35, from August, 1970, the first season of recruitment after the spill, through June, 1971, just before the second season, showed that rates of mortality of that polychaete were not significantly different at the 0.95 level of confidence, according to classical statistics. This lack of significance probably reflects the broad scatter and fewness of points for each regression curve. All four regressions were negative in slope. That for station 10 was steepest, -1649, because the density was very much greater in August than in later months, and three to five times greater than densities at the other three stations. The curve described by the remaining points was similar to those of the other stations. The slope of the curve for station 9 was -796, that for station 35 was -890, and that for station 20 was -714.

The same analysis of the density of the rest of the fauna at these same stations in the second year also showed that regresssions were not significantly different from one another at the 0.95 level of confidence. The slopes of these regressions were much less than those for *Mediomastus*. The slope was greatest for station 10 (-343), less for station 9 (-199), slight for station 20 (-54). The slope for station 35 was positive (+83). The relatively high density at station 10 in August, 1970, considerably increased the slope of the curve.

Subdominants

Subdominants here are those species which composed more than 10% of the fauna without the one most abundant species, either *Capitella* or *Mediomastus*.

At station 31 subdominants composed about 75% of the many samples in which there were subdominants (Figure 33). Four samples lacked subdominants. There was no obvious tendency for the proportion of subdominants to decrease with the passage of time. In general, two species were subdominant in any one sample, especially in the later years. The subdominants belong to two major taxa, Polychaeta and Gastropoda. The *Polydora ligni-Microphthalmus aberrans* assemblage of the first months gave way in the summer of 1970 to the *Haminoea solitaria-Bittium alternatum* assemblage. By early 1973 *Streblospio benedicti* and *Nereis succinea* were the chief subdominants. Several species were subdominant only occasionally, and no one species was subdominant in a large number of samples throughout the sampling period. Only *Microphthalmus aberrans* seems to have been seasonal in abundance. Eight of the eleven species subdominant at this station were subdominant at intertidal stations II and IV, despite differences in sediments and water depth.

At station 9 subdominants occurred in every sample, and composed slightly less than half of the fauna (Figure 34). The number of subdominants in a sample decreased with time. The subdominants belong to four major taxa, Polychaeta, Gastropoda, Bivalvia, and Nemertinea. The *Tubulanus pellucidus* assemblage of the first few months gave way to the *Syllides verrilli-Nephtys incisa* assemblage. Gastropods became less common after the first year, and

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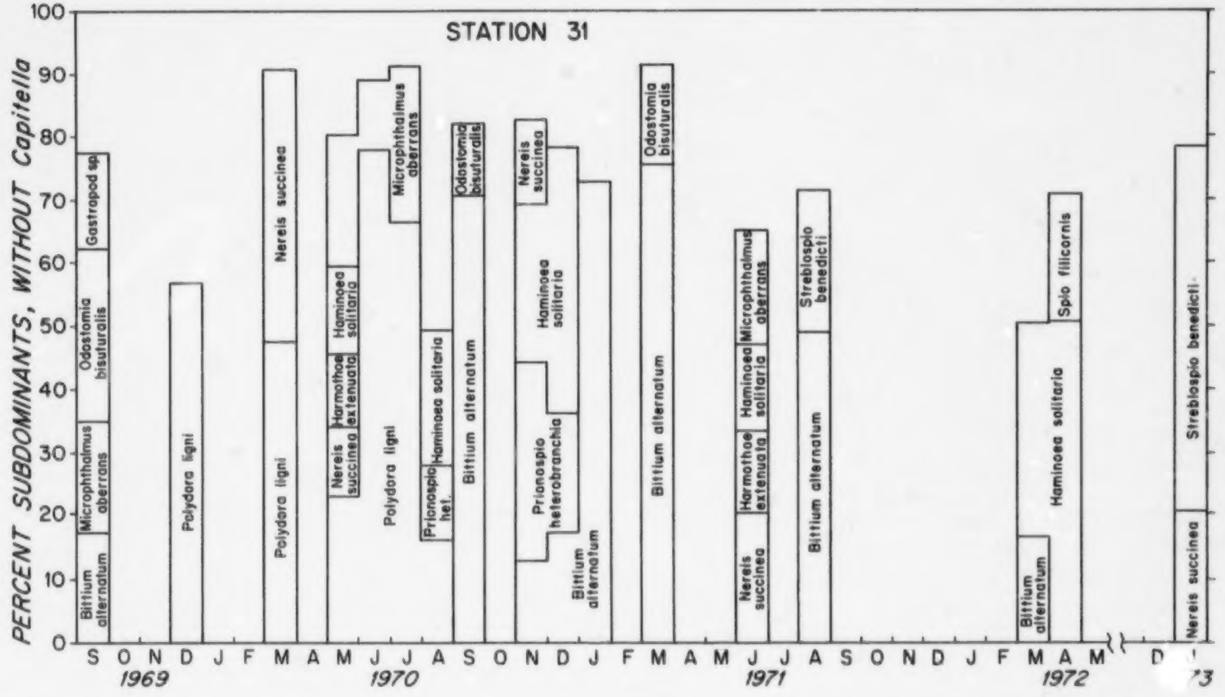

Figure 33. Subdominants at station 31.

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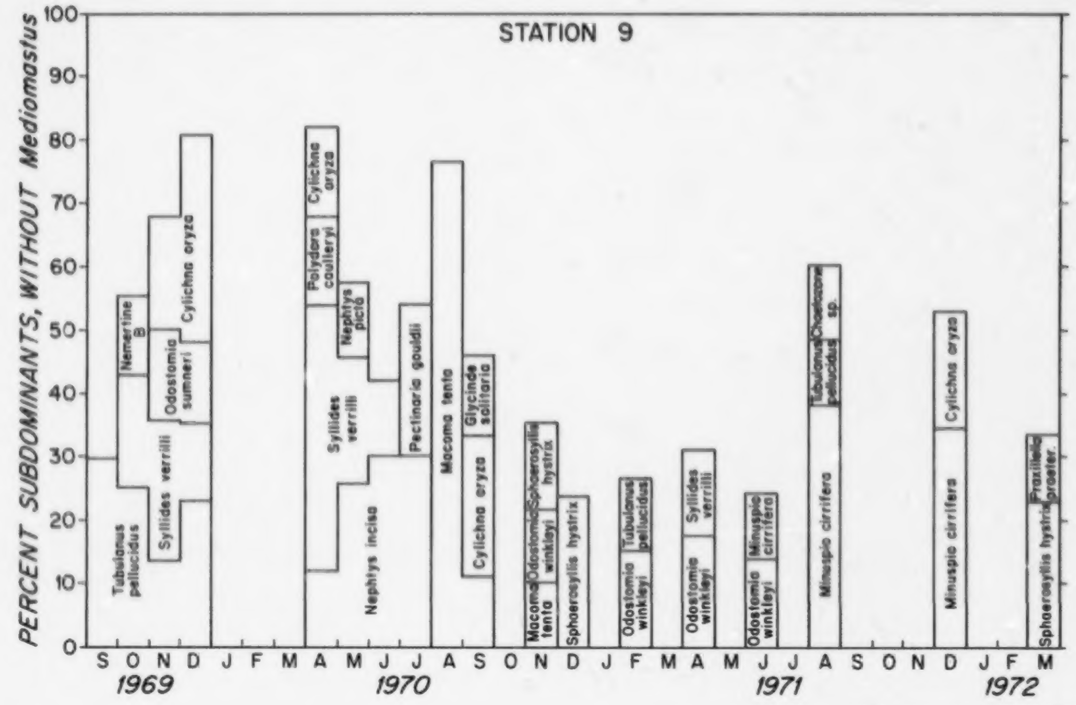

Figure 34. Subdominants at station 9. *Praxillella praeter.* = *Praxillella praetermissa.*

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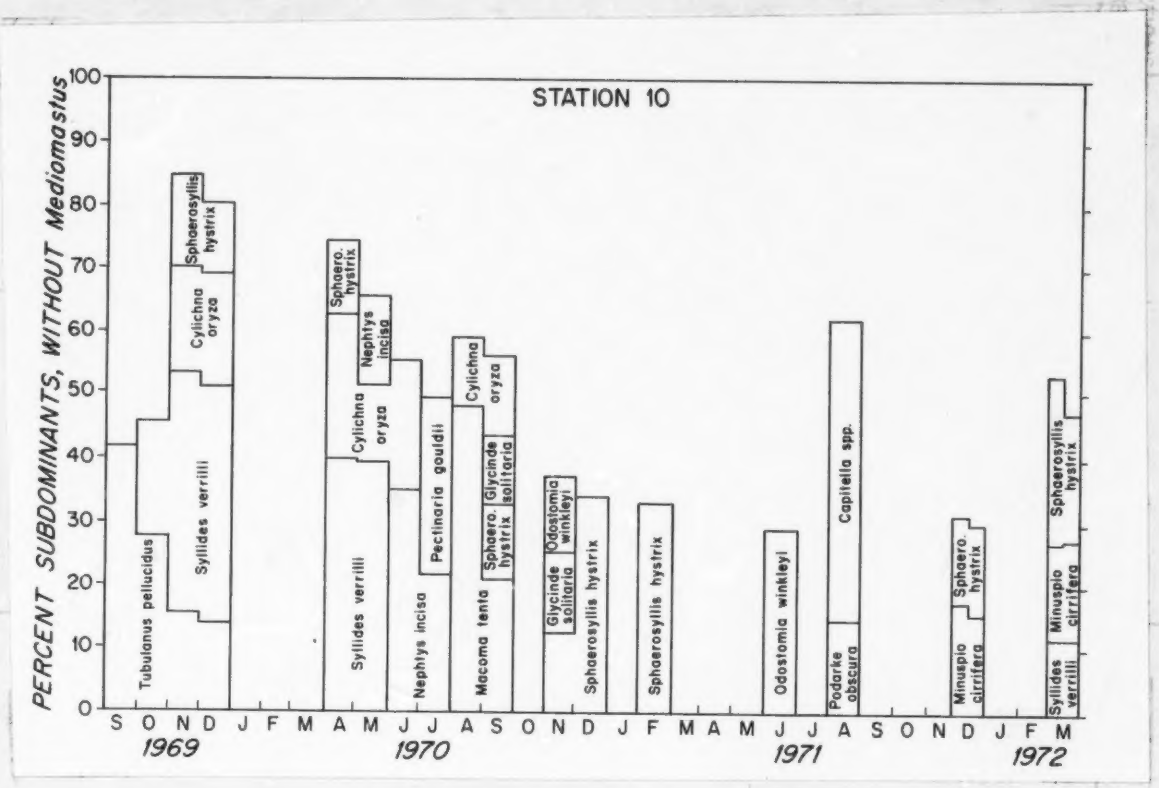

Figure 35. Subdominants at station 10. Replicate samples taken in December, 1971, and March, 1972, were analyzed.

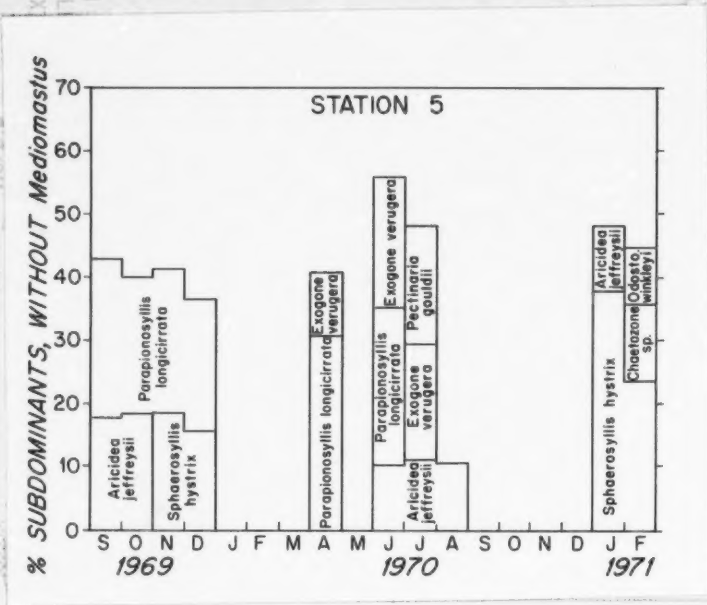

Figure 36. Subdominants at station 5. *Odosto. winkleyi* = *Odostomia winkleyi*.

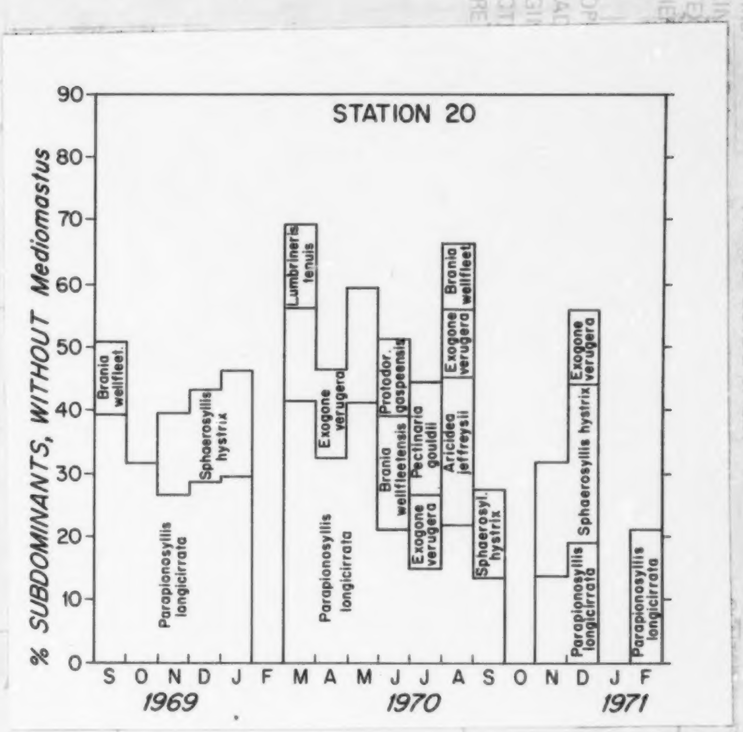

Figure 37. Subdominants at station 20. *Protodor. gaspeensis* = *Protodorvillea gaspeensis*.

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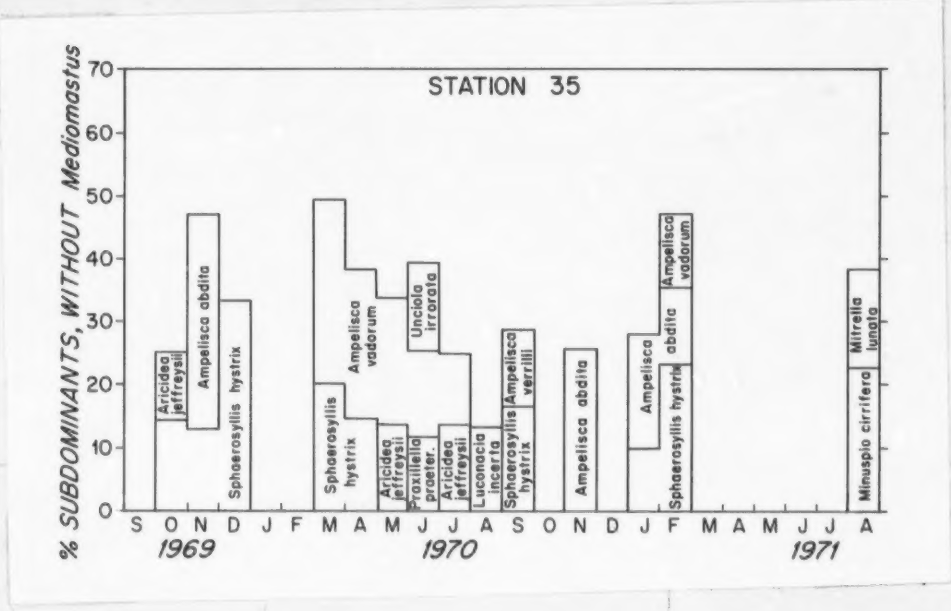

Figure 38. Subdominants at station 35. *Praxillella praeter.* = *Praxillella praetermissa.*

one species of *Odostomia* succeeded another. During the second year,the subdominant portion of the fauna decreased, especially after *Macoma tenta* waned. *Minuspio cirrifera* was the most constant subdominant in the late second and early third year. Most species were subdominant in only a few months, several were so in consecutive months. The subdominants of this station were not those of station 31.

The specific and temporal arrays of subdominants at station 10 (Figure 35) were very similar to those at station 9. *Cylichna oryza* and *Sphaerosyllis hystrix* were more commonly subdominant at station 10, *Odostomia winkleyi* less so. Fewer species were subdominant at any one time at station 10, but on the average composed slightly more of the fauna here than at station 9. The tendency for reduction in numbers of species subdominant in a sample with the passage of time was less clear at station 10. As at station 9, subdominants occurred in every sample, and belonged to the same major taxa. *Capitella,* so abundant at station 31, was subdominant at station 10 only in August, 1971, when fuel oil reinvaded this site. The subdominants of station 10 were not those of station 31. *Sphaerosyllis hystrix* appears to have been seasonal in abundance.

All samples at station 5 contained subdominants, which comprised, on the average only about 40% of the fauna (Figure 36). This proportion increased slightly with time. The number of subdominants in a sample was almost always two. At both this station and station 20, *Sphaerosyllis hystrix* was most common in the autumn, winter, and spring, whereas *Exogone verugera* was most common in the late spring and early summer. When the bottom sediments were unusually fine, the subdominants were unusual in their paucity (August, 1970) or identity (February, 1971). Members of two major taxa, Polychaeta and Gastropoda, were abundant. Whereas polychaetes were subdominant in every sample, gastropods became subdominant only in the second year. Some of the species subdominant at station 5 were such at stations at stations 9 and 10, but none was subdominant at station 31.

The eight species subdominant at station 20 belong to two major taxa, Polychaeta and Nemertinea, and on the average composed about 46% of the fauna (Figure 37). This proportion increased somewhat in the latter half of the first year. Subdominants, usually two, occurred in every sample. *Parapionosyllis longicirrata,* also commonly subdominant at station 5, was subdominant for a longer time at station 20. Most of the species subdominant at this station were so at station 5 as well. Station 20 shared only *Pectinaria gouldii* and *Sphaerosyllis hystrix* as subdominants with stations 9 and 10. None of the species subdominant at station 20 was so at station 31.

The average proportion of the fauna comprised by subdominants was only one-third at station 35 (Figure 38). The change in this proportion was slight and seemingly seasonal. Subdominants, usually two, were in every sample. *Sphaerosyllis hystrix* was abundant in the autumn, winter, and early spring here as at stations 5 and 20. *Ampelisca vadorum* was usually subdominant in the spring and early summer, whereas *A. abdita* prevailed in colder seasons. Gastropods did not appear until late in the second year, along with a polychaete different from its predecessors. Some of the subdominants at station 35 were also subdominant at station 20, 5, 9, and 10. None was in

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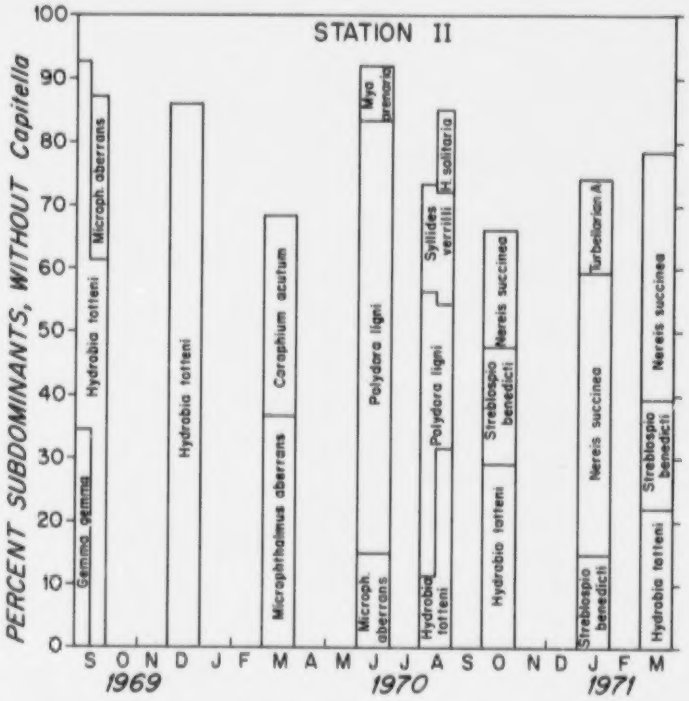

Figure 39. Subdominants at station II. Two samples were taken in September, 1969: one on the 19th and another on the 26th. Replicate samples taken in August, 1970, were analyzed. *H. solitaria* = *Haminoea solitaria*.

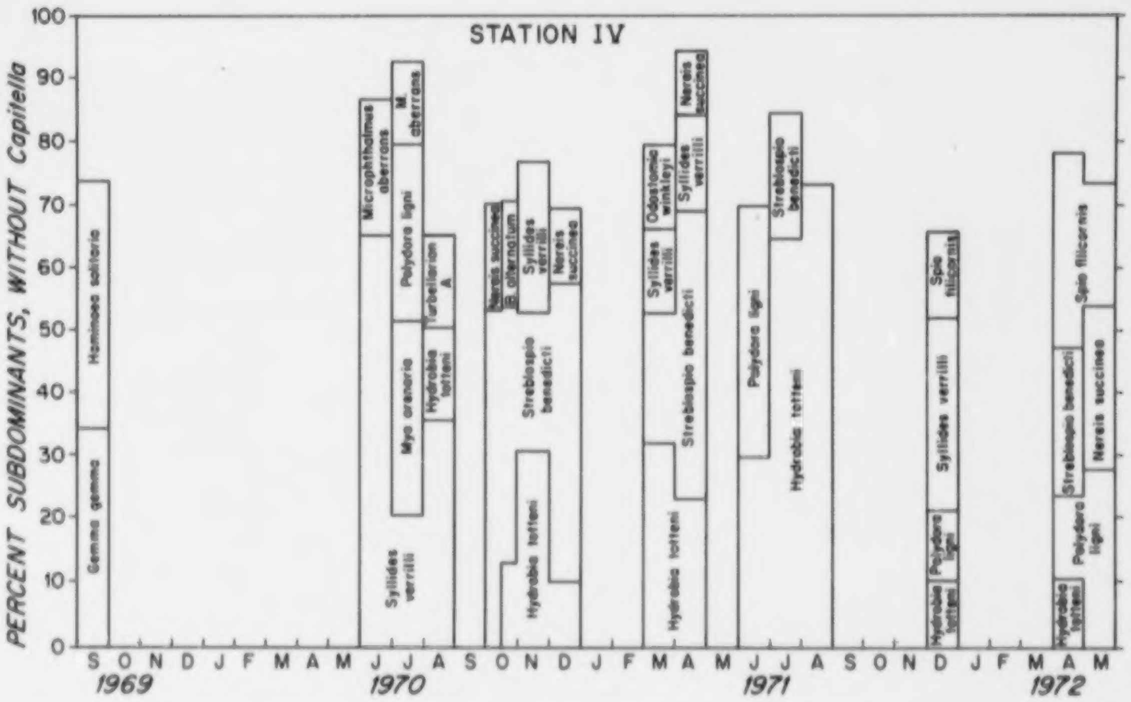

Figure 40. Subdominants at station IV. Replicate samples taken in October, 1970, were analyzed. *B. alternatum* = *Bittium alternatum*.

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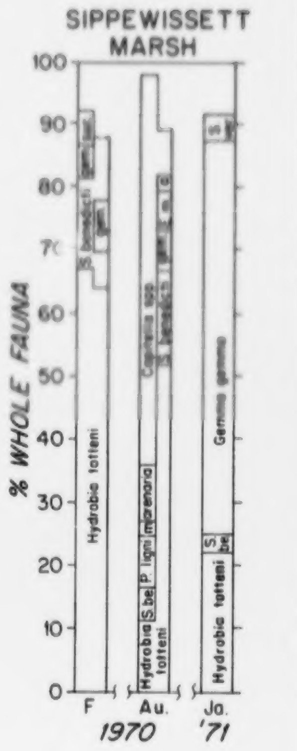

Figure 41. Abundant species at control station in Sippewissett Marsh. *S. be.* = *S. benedicti* = *Streblospio benedicti*. *gem.* = *Gemma gemma*. *suc.* = *Nereis succinea*. *P. ligni* = *Polydora ligni*. *m.* = *Edotea montosa*. *a* = *arenaria* = *Mya arenaria*. *S. ver.* = *Syllides verrilli*.

common with station 31. Of the subtidal stations, station 35 was unusual in its high proportion of amphipods.

At intertidal station II subdominants composed, on the average, 75% of those samples which had subdominants (Figure 39). The percentage decreased slightly in the second year. Two samples lacked subdominants. As at station 31 and IV, the number of subdominants in a sample was fairly variable; it increased slightly with the passage of time. *Gemma gemma* was subdominant only in the first few days after the spill. *Hydrobia totteni* was the only species which was subdominant in several samples; others occurred sporadically. In the second year the *Nereis succinea-Streblospio benedicti* assemblage became subdominant. Many species subdominant at this station were so at station 31.

At intertidal station IV subdominants composed almost 80% of the samples which had subdominants; the proportion fluctuated somewhat (Figure 40). Six samples were too sparse to have subdominants. The number of subdominants in a sample increased with the passage of time. As at station II, *Gemma gemma* was common only in the first few days after the spill. *Hydrobia totteni* and *Syllides verrilli* were subdominant in several samples. *Nereis succinea* and *Streblospio benedicti* occurred together here, as at station II, but their relative proportions were reversed. Both here and at station 31, *Spio filicornis* became abundant in the third year. Several species were subdominant infrequently.

At the control station in Sippewissett Marsh two species composed more than 10% of a sample, and together made up about 77% of the fauna (Figure 41). This percentage varied, but did not show any temporal trend. *Hydrobia totteni* occurred in all samples and was dominant in three. The suite of species which together composed about 90% of the fauna was almost always the same. *Capitella* was abundant only when it invaded from test plots. Several species which were abundant in Sippewissett Marsh were subdominant in the intertidal zone of Wild Harbor River as well, but the minor species at the control station were different.

Ampeliscid Amphipods

At station 31 five living ampeliscids were taken in a trawl sample three days after the spill. From September 25, 1969, to January, 1973, these animals were absent from this station. Living ampeliscids were absent from station 30 in the first months after the spill. Their appearance in later months was sporadic.

At station 9 these amphipods died almost immediately after the spill (Figure 42). From October, 1969, through July, 1970, only dead ampeliscids were found. Within the next month, they began to recolonize this station. Thereafter live animals were more numerous than dead. The pattern was very similar at station 10 (Figure 43). Shortly after the spill the living outnumbered the dead, but from October, 1969, through August, 1970, more ampeliscids were dead than alive. Living animals arrived at this station in September, 1970, and were more numerous than dead ones until August, 1971,

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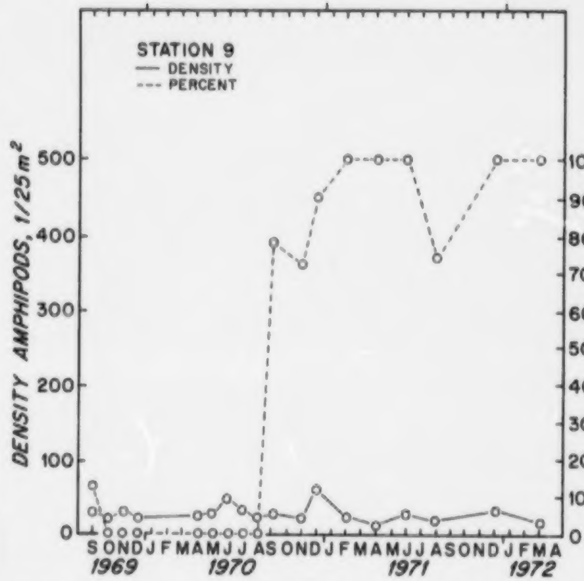

Figure 42. Density of ampeliscid amphipods in $1/25\ m^2$ at station 9, and the proportion found alive.

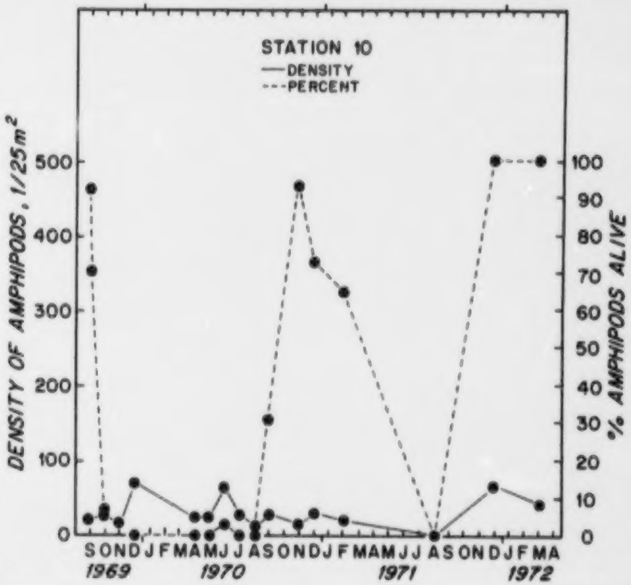

Figure 43. Density of ampeliscid amphipods in $1/25\ m^2$ at station 10, and the proportion found alive.

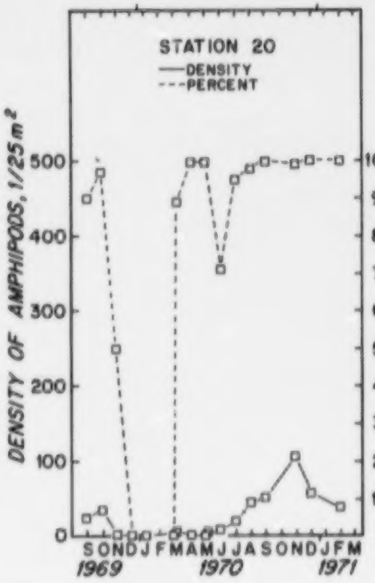

Figure 44. Density of ampeliscid amphipods in 1/25 m^2 at station 20, and the proportion found alive.

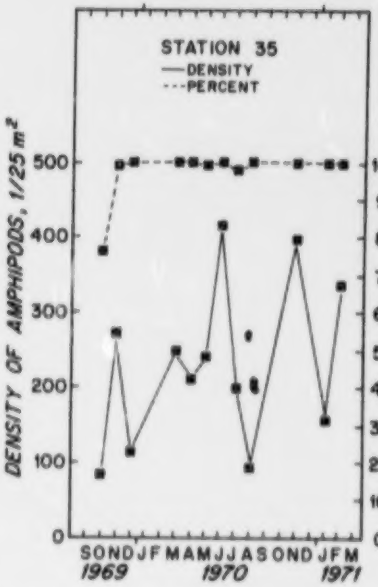

Figure 45. Density of ampeliscid amphipods in 1/25 m^2 at station 35, and the proportion found alive.

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when less-degraded #2 fuel oil reinvaded this site. In that month, amphipods, as well as many other kinds of animals, died. Within four months pollution lessened, and amphipods again re-established themselves at station 10.

Shortly after the spill, amphipods at station 20 were little affected by the already markedly modified oil in the sediments (Figure 44). By October, however, less-degraded oil arrived at this site and killed most of the amphipods. From November, 1969, through June, 1970, ampeliscids, both living and dead, were generally few. The amphipods quickly recolonized this site in the summer of 1970, and living animals considerably outnumbered the dead. Ampeliscids continued to live at this station for the rest of the sampling period.

At station 35 ampeliscids suffered only slightly from the oil (Figure 45). After October, 1969, living animals were abundant, dead ones rare or absent. At offshore station 36, ampeliscids flourished between November, 1969, and February, 1971. The number of ampeliscids seems to have been normal in November, 1969, at station 37, where fuel oil was absent from the sediments. In the winter and early spring following the spill, fuel oil invaded this site and the ampeliscids died.

Coefficient of Variation

The curves (Figure 46) representing the coefficients of variation of species having a mean density of three or more at each station form three groups: that of stations 20 and 35, that of stations 9 and 10, and that of station 31, in order of increasing coefficient. Forty-two percent of these species at stations 20 and 35 have coefficients lower than the least value at station 9; 69% of the species at station 20 and 55% of those at station 35 have coefficients lower than the lowest value of station 31. Only 28% of the species at station 10 and 30% of those at station 9 have coefficients lower than the least value at station 31. The greatest value at station 35 is considerably lower than the highest values of the other stations.

Many of the species numerous at stations 9, 10, and 31 were quite variable in abundance (Figure 47). Species abundant at stations 20 and 35 were only slightly variable. At all stations, minor species were variable in abundance, more so at stations 9, 10, and 31. We have excluded from this analysis four species so much more abundant in the second year at stations 9, 10, 20 and 35 that their high coefficients overshadow those coefficients of other species. The species excluded are *Mediomastus ambiseta, Glycinde solitaria, Minuspio cirrifera,* and *Odostomia winkleyi,* and the abundant but transient *Pholoe minuta* and *Pectinaria gouldii.* Also omitted are epifaunal species (amphipods, and gastropods other than naticids) because they tend to respond to surficial features and are, therefore, more patchily distributed (more variable from sample to sample) than are infaunal species.

We ranked the stations according to increasing coefficient of variation within each of several density intervals (Table 4) and used Kendall's Coefficient of Concordance (Siegel, 1956) to test whether the ranks of a station in all density intervals are similar among themselves. For these five

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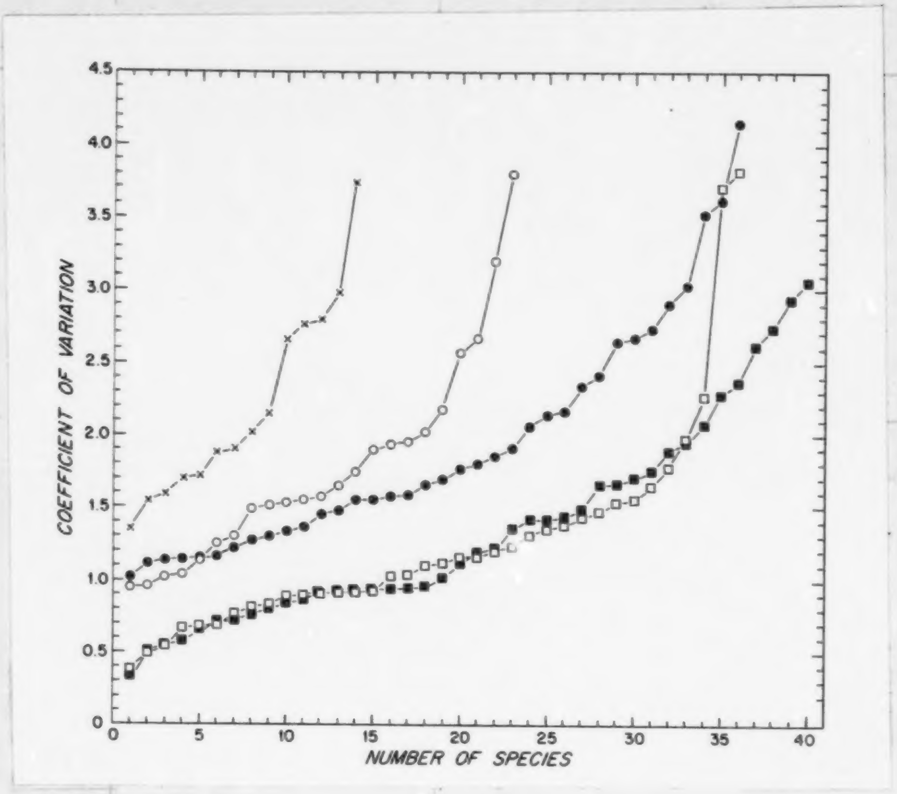

Figure 46. Coefficients of variation of species having mean densities of 3 or more at stations 31, 9, 10, 20, and 35.

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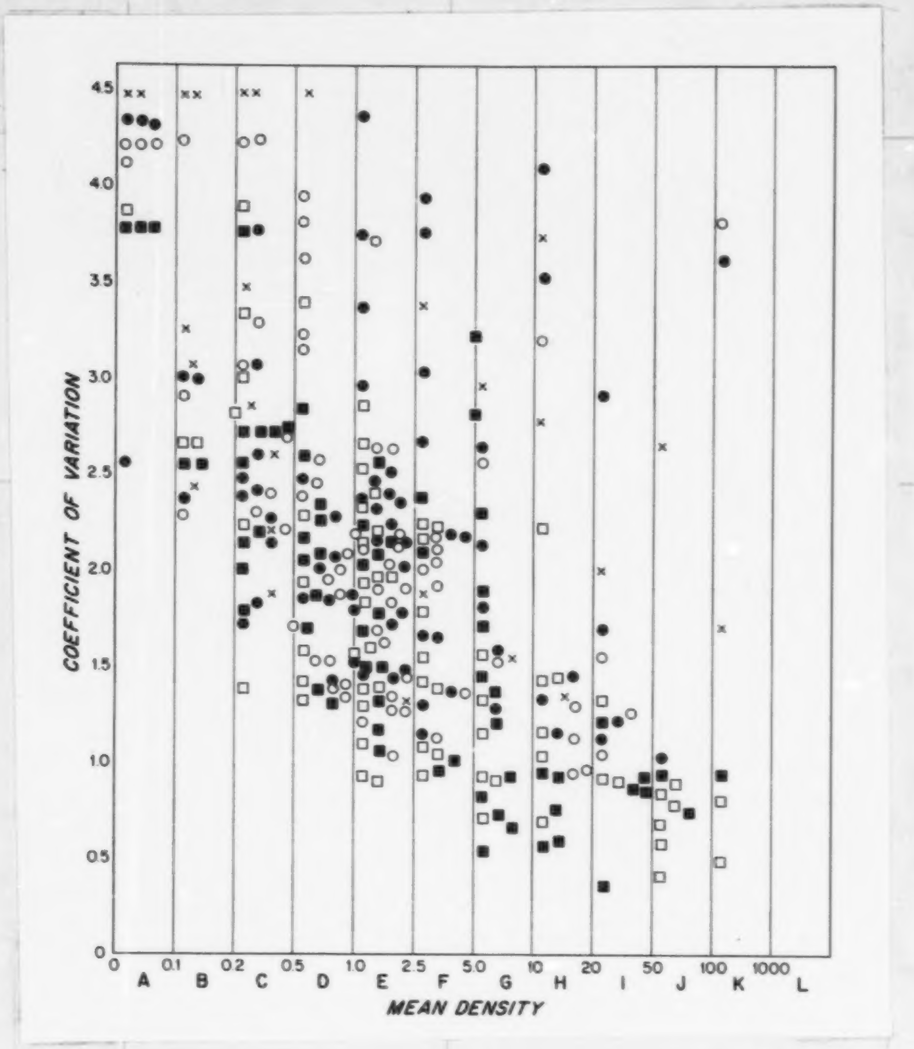

Figure 47. Relationship between coefficient of variation and mean density of species at stations 31, 9, 10, 20, and 35. Epifaunal species, species much more abundant in the second year than in the first, and transient species omitted.

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TABLE 4. RANKS OF STATIONS 20, 35, 10, 9, AND 31 BY INCREASING COEFFICIENTS OF VARIATION AT THE MEAN DENSITY INTERVALS. RANKS IN BRACKETS OMITTED FROM ANALYSIS

Density interval	Mean density	Stations 20	35	10	9	31
	1000					
K		1	2	4	5	3
	100					
J		(1)	(2)	(3)	-	(4)
	50					
I		2	1	4	3	5
	20					
H		2	1	4	3	5
	10					
G		1	2	4	3	5
	5.0					
F		1	4	3	2	5
	2.5					
E		3	2	5	4	1
	1.0					
D		1	3	2	4	5
	0.5					
C		3	1	2	4	5
	0.2					
B		2	1	3	4	5
	0.1					
Sum		16	17	31	42	39
Av. Rank		1.78	1.89	3.44	3.56	4.33

stations and the four density intervals of mean density greater than five containing values for every station, the observed sum of squares, 128, exceeds the critical value, 109.3, at the 0.01 level of significance. We therefore rejected the null hypothesis that the rank of a station according to coefficient of variation is independent of density at the 99% confidence limit. Lack of representation of station 9 forced us to omit mean density interval J from the calculations. Stations 20 and 35 have the lowest mean ranks in most intervals, including interval J. The values for stations 9 and 10 are similar, and higher than those for stations 20 and 35, indicating that the faunas at the nearer-shore stations fluctuated much more than those of stations 20 and 35. Kendall's Coefficient of Concordance over the intervals of lower mean density, B-F, for the five stations yields a χ^2 of 6.80; the probability that the ranks are independent of density is between 0.20 and 0.10. Even at these low mean densities, the faunas at stations 20 and 35 clearly tended to be less variable than those at stations 9, 10, and 31.

In seven of the nine intervals, station 31 ranks fifth, most variable. In interval J, omitted from the calculations, this station also ranks last. It ranks first in interval E, and third in interval K. In interval E, however, only *Syllides verrilli* is present. The high average rank, 4.33, indicates that changes in density and faunal composition at this station were sudden and rapid for at least three years after the spill.

We used the Mann-Whitney U Test to test the null hypothesis that the mean coefficient of variation for a suite of species each having a given minimal mean density (here, 3 individuals in 1/25 m^2) at one station is not significantly different from the mean coefficient of variation for the corresponding suite of species from another station. Because mode of life and temporal constancy are of no import to these calculations, all species of requisite mean density are included. This test shows (Table 5) that only two pairs of stations, 20 and 35, and 9 and 10, have mean coefficients of variation not significantly different. Station 31 is significantly different from each of the other stations in this regard.

The mean coefficients of stations 20 and 35 are not significantly different, and the arithmetic difference between them is slight (Table 5). The overlap of the ranges of coefficients is fairly great (Figure 48). Amphipods were less variable in abundance at station 35 than at station 20, whereas *Parapionosyllis longicirrata, Brania wellfleetensis,* and *Amphareta arctica* were more variable at station 35. These differences lessened the similarity of the mean coefficients of these two stations.

The mean coefficients of stations 9 and 10 are statistically and arithmetically similar. The overlap of the ranges of coefficients is considerable (Figure 49). *Mediomastus ambiseta* was much less variable at station 9, *Sphaerosyllis hystrix, Glycera americana,* and *Phascolion strombi* were less variable at station 10.

The mean coefficient of variation of station 31 is significantly different from those of the other stations; the arithmetic differences are considerable. The range of coefficients of this station and those of

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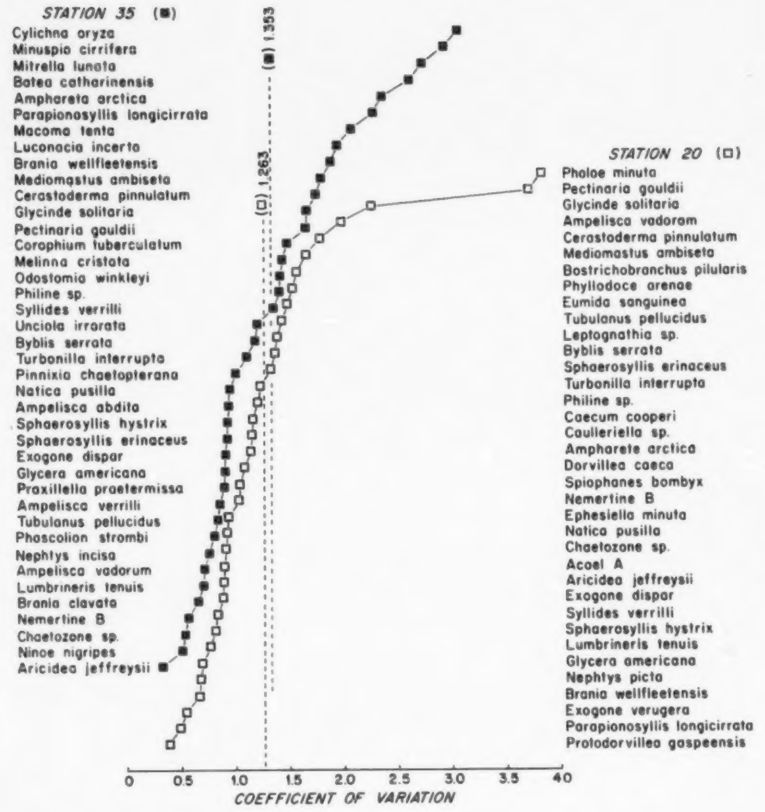

Figure 48. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 35 and 20.

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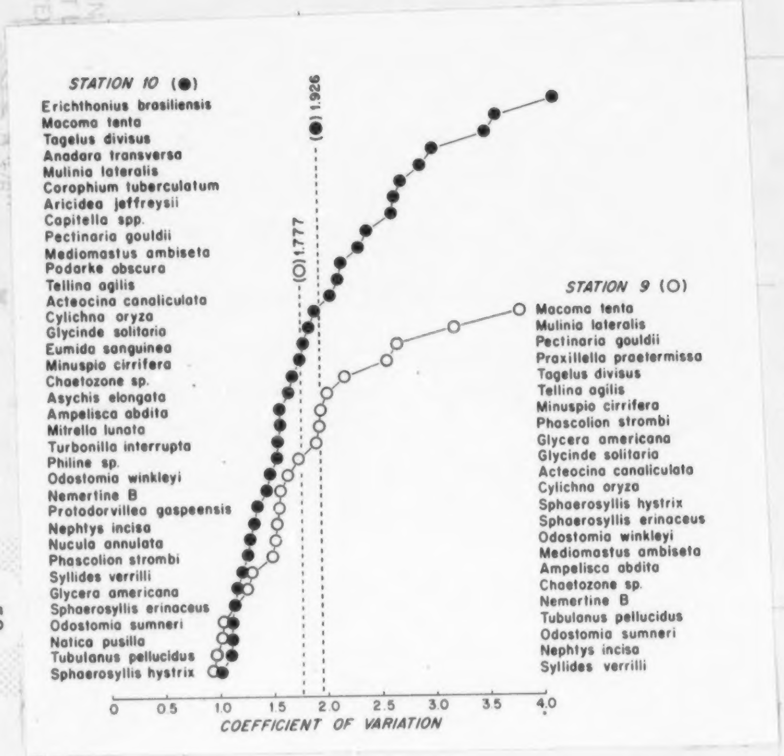

Figure 49. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 9 and 10.

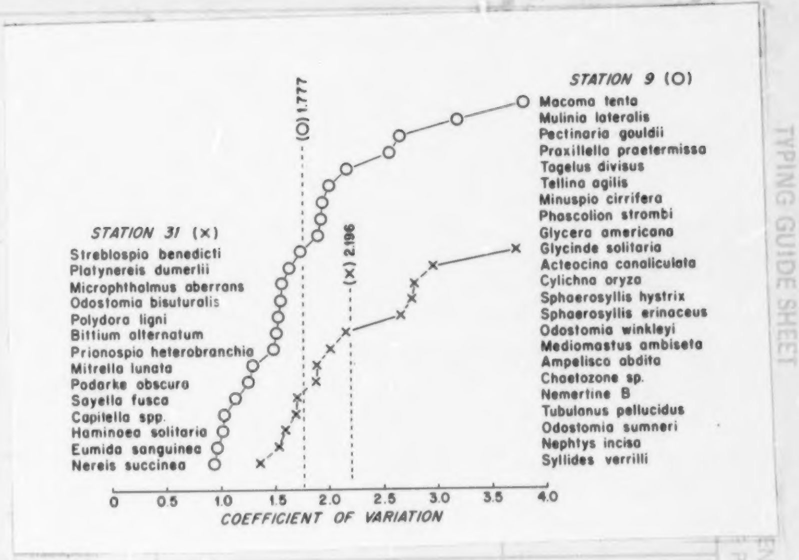

Figure 50. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 31 and 9.

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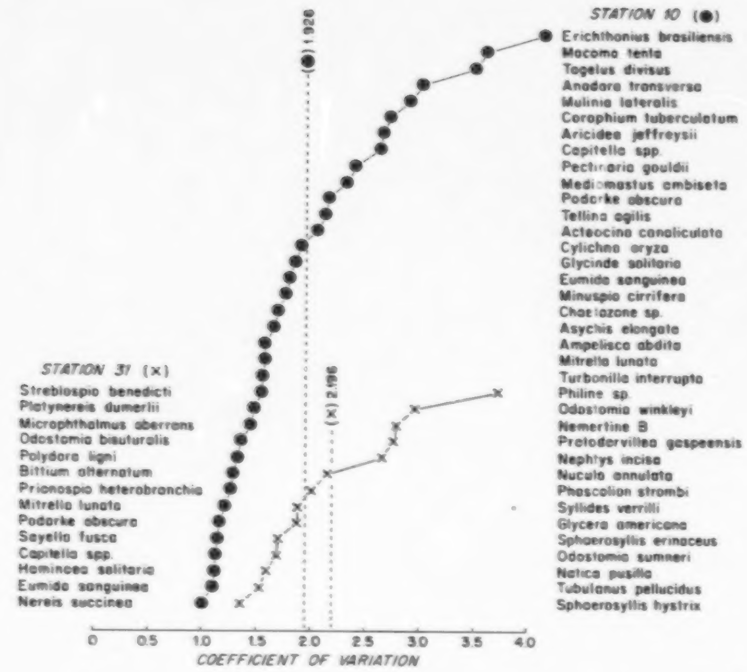

Figure 51. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 31 and 10.

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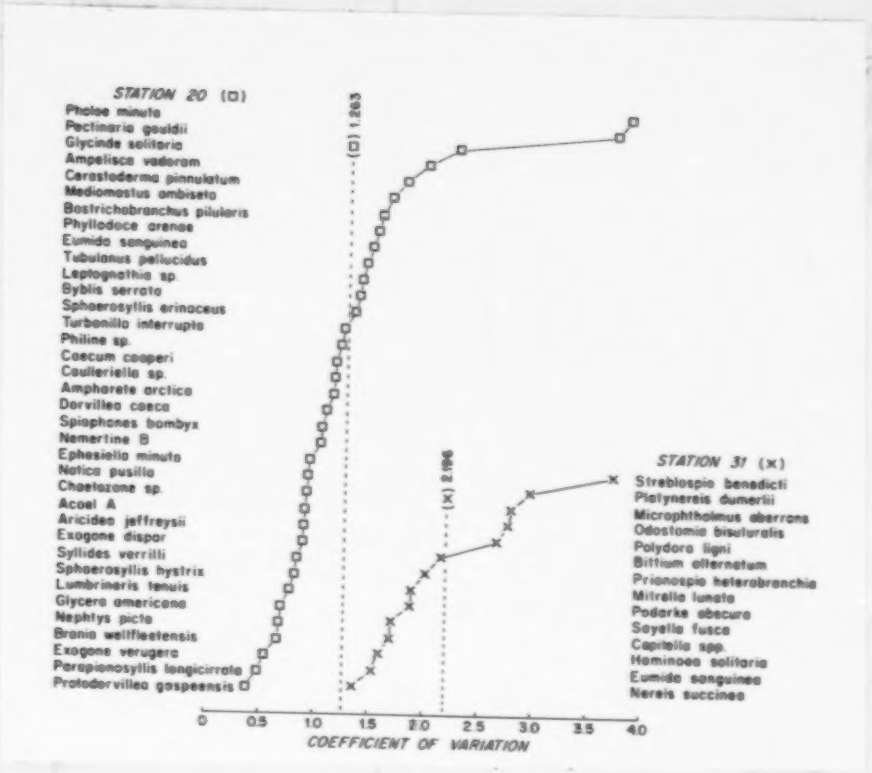

Figure 52. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 31 and 20.

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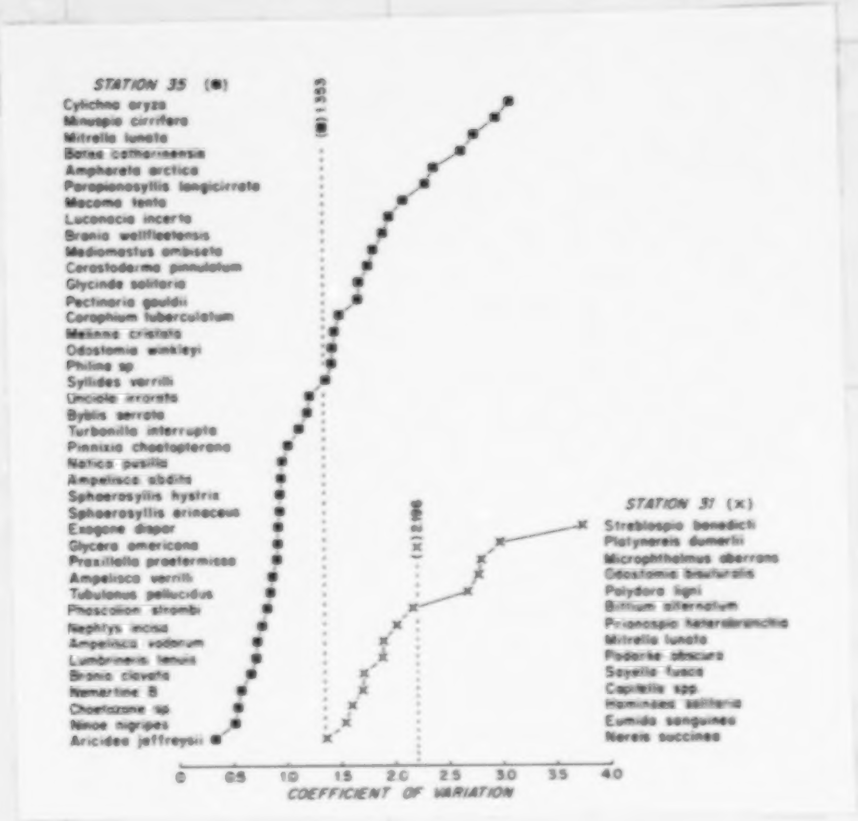

Figure 53. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 31 and 35.

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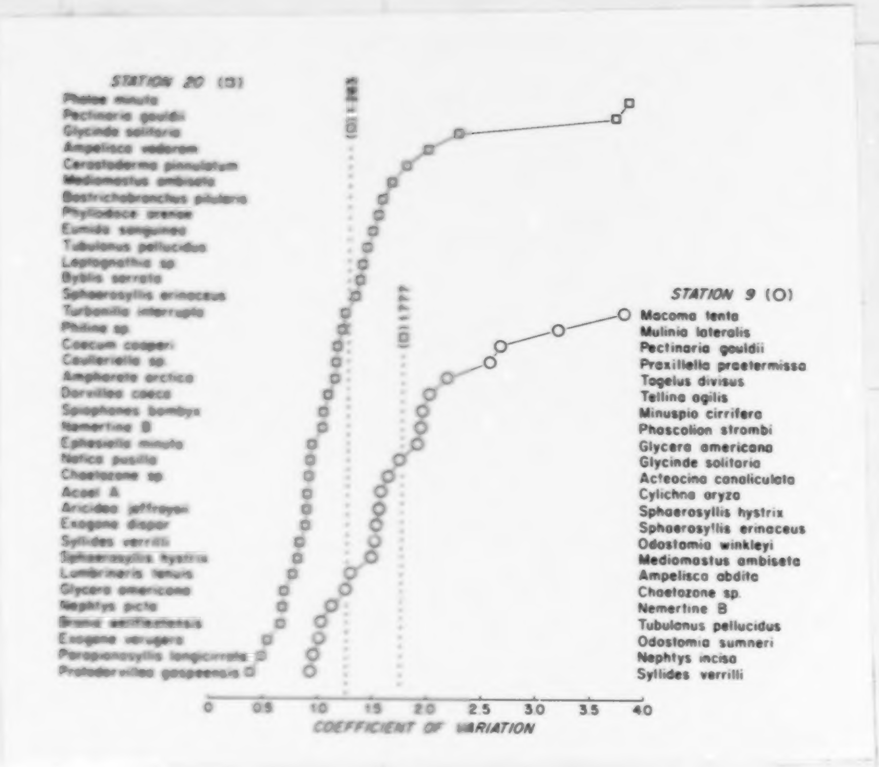

Figure 54. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 9 and 20.

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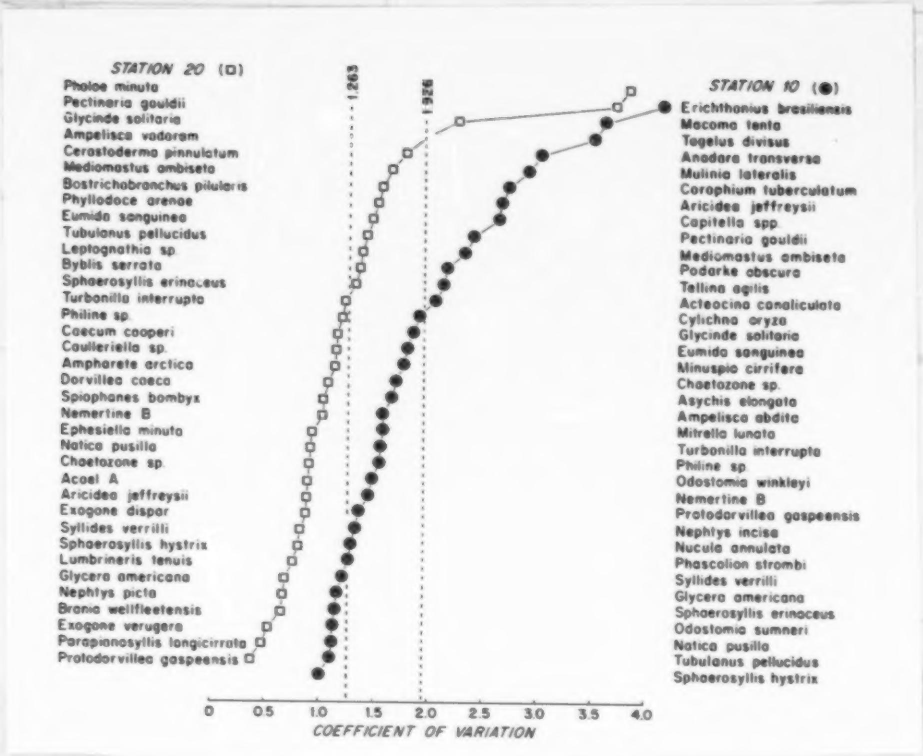

Figure 55. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 10 and 20.

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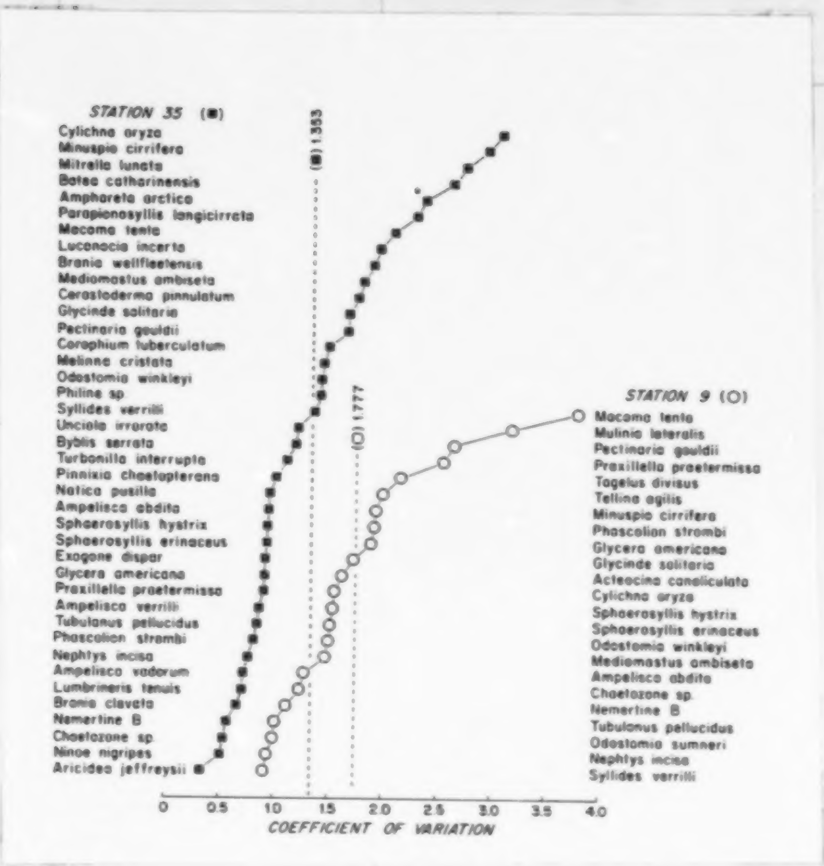

Figure 56. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 9 and 35.

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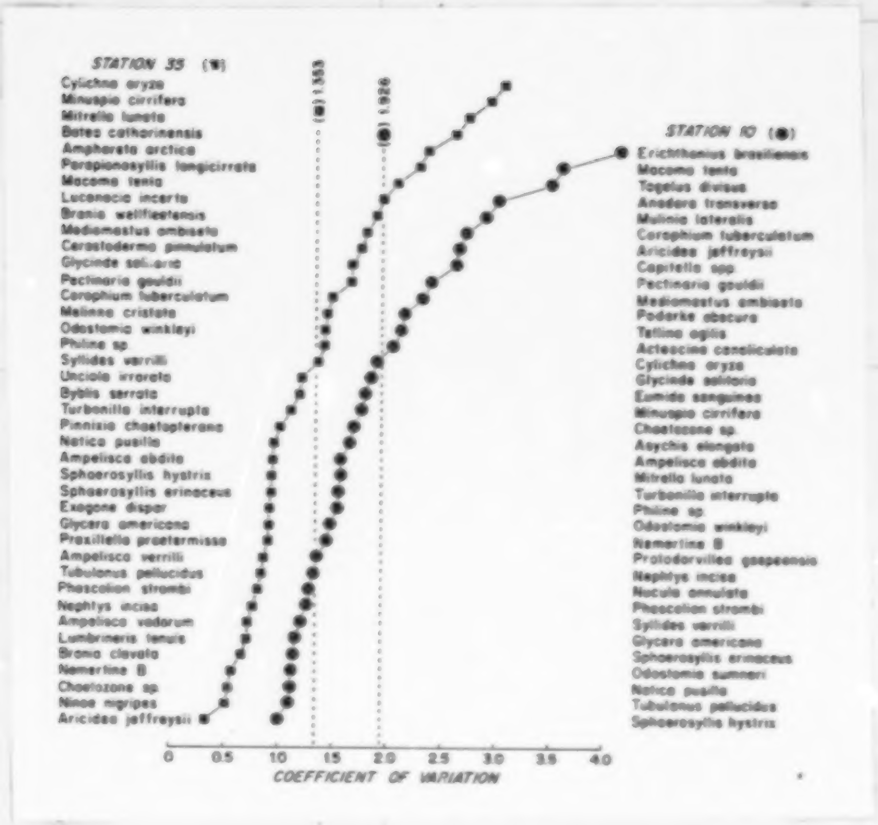

Figure 57. Coefficients of variation of all species having mean densities of 3 or more in 1/25 m^2 at stations 10 and 35.

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TABLE 5. PROBABILITY VALUES ASSOCIATED WITH THE MANN-WHITNEY U TEST OF COEFFICIENTS OF VARIATION COMPARISONS BETWEEN ANY TWO STATIONS. *DIFFERENCE BETWEEN MEAN COEFFICIENTS OF VARIATION OF ANY TWO STATIONS*

Station	20	35	10	9	31	Mean C. V.
20	X	*0.090*	*0.663*	*0.514*	*0.933*	1.263
35	0.4716	X	*0.573*	*0.424*	*0.843*	1.353
10	0.00006	0.0006	X	*0.149*	*0.270*	1.926
9	0.001	0.008	0.4778	X	*0.419*	1.777
31	0.00006	0.00046	0.0672	0.0524	X	2.196
No. species	36	40	36	23	14	

TABLE 6. NUMBER OF SPECIES PRESENT AT MEAN DENSITIES $\geq$3.0 IN 1/25 M^2 COMMON TO EACH PAIR OF STATIONS; *PROBABILITY THAT COEFFICIENTS OF VARIATION FOR SPECIES SHARED BY TWO STATIONS ARE NOT DIFFERENT.*

Station	20	35	10	9	31
20	X	*0.832*	*0.076*	*0.754*	-
35	22	X	*0.004*	*0.030*	-
10	16	22	X	*0.524*	-
9	10	18	22	X	-
31	1	1	4	0	X

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stations 9 and 10, respectively, overlap to a moderate or considerable extent (Figure 50, 51). The range of coefficients of station 31 and those of stations 20 and 35, respectively, overlap little or not at all (Figures 52, 53). The one species common to stations 31 and 35, *Mitrella lunata,* was more variable at station 35. The mean coefficients of stations 31 and 10 differ to a lesser extent than the p value of 0.0672 might suggest. This anomaly may be due in part to the fact that five of the coefficients of station 10 are greater than 3.0, whereas only one coefficient at station 31 is of this magnitude.

The mean coefficients of variation of the four remaining pairs of stations (Figures 54-57) are also signficiantly different. In each case, the station nearer shore has a mean coefficient greater than that of the station farther from shore. The majority of species shared by two stations have higher coefficents at the station closer to shore. Overlaps of ranges of coefficients are slight to moderate.

Some may argue that those species occurring at only the more heavily oiled stations owe their presence there solely to the oil, and are by nature more variable than those species at lightly oiled stations, and further that these variable species at the more heavily oiled sites may unduly influence the patterns of the coefficients of variation. To answer this objection, we include in another analysis only those species shared by any two stations at mean densities of three or more. Because only four species at station 31 occurred at any of the other four stations in densities sufficient for valid testing, we omitted station 31 from the analysis.

The null hypothesis states:

$$p(X_A > X_B) = p(X_A < X_B) = 1/2$$

in which X_A are coefficients of variation at station A, and X_B are coefficients of variation at station B. The null hypothesis is proven when half of the species common to the two stations have higher coefficients at one of the stations. The greater the departure from parity, the lower the probability, p, that the coefficients of variation at the two stations are not significantly different.

The large values of p for pairs of stations 20 and 35, 9 and 20, and 9 and 10 show that the coefficients for species shared here are not significantly different (Table 6). The results for stations 20 and 35 and stations 9 and 10 agree with the results of the test in which every species present at a mean density of three or more is included regardless of its absence from a station. The high p value of 0.754 for stations 9 and 20 differs greatly from the earlier value of less than 0.001. As in the earlier test, the p values of the remaining pairs of stations demonstrate that the coefficients of variation of the shared species are significantly different.

To reduce noise, we removed *Glycinde solitaria, Minuspio cirrifera, Mediomastus ambiseta,* and *Odostomia winkleyi,* which were much more abundant in the second year after the spill than in the first, and *Pectinaria gouldii,* which was present at very low constancy. This test (Table 7)also yields p values greater than 0.5 for pairs of stations 20 and 35, and 9 and 10. The p value for the pair 9 and 20 is much lower in this test than that in which all abundant species in common are included. The number of species shared by stations 9 and 20 is seven, marginally low. Although six of these seven species have higher coefficients at station 9, the p value is only 0.124.

TABLE 7. NUMBER OF SPECIES PRESENT AT MEAN DENSITIES $\geq$ 3.0 IN 1/25 M^2 COMMON TO EACH PAIR OF STATIONS. *THE PROBABILITY THAT THE COEFFICIENTS OF VARIATION OF SPECIES SHARED BY TWO STATIONS ARE NOT DIFFERENT, OMITTING FOUR SPECIES MUCH MORE ABUNDANT AT ALL FOUR STATIONS IN THE SECOND YEAR THAN IN THE FIRST, AND A FIFTH SPECIES OF LOW CONSTANCY*

Station	20	35	10	9
20	X	*1.000*	*0.022*	*0.124*
35	19	X	*0.012*	*0.022*
10	13	17	X	*0.630*
9	7	13	17	X

Constancy

Both absolute and relative numbers of species present in more than 45% of the samples from a station was greatest at stations farthest from shore and least at stations 31, II, and IV (Table 8).

Almost all species constant at station 31 were infrequent at the offshore stations. Almost all the highly constant species of stations 9 and 10 were as constant or much more constant at the stations farther offshore. Only a very few species were most constant at stations 9 and 10. Several species were highly constant at one or more of stations 5, 20, and 35. The proportion of highly constant species was greatest at the three stations farthest from shore, and least at nearshore station 31 (Figure 58).

More species and a greater proportion of species were constant at the control station in Sippewissett Marsh than at stations II and IV in the intertidal zone of Wild Harbor River (Table 8, Figure 59). Most of the constant species common to Sippewissett and either of the other stations were more

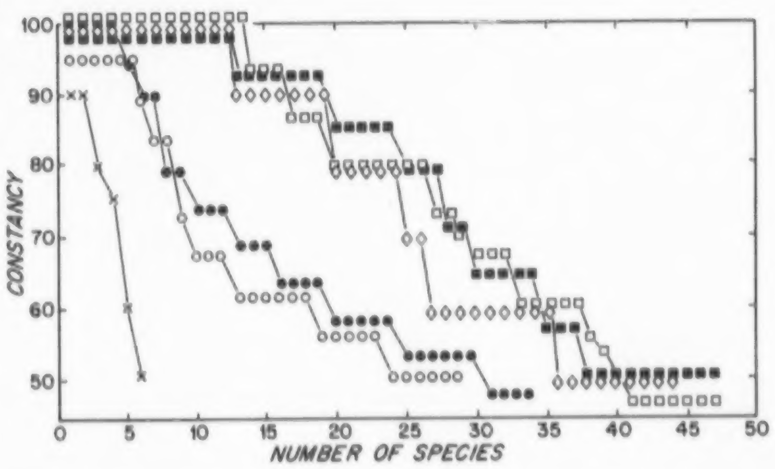
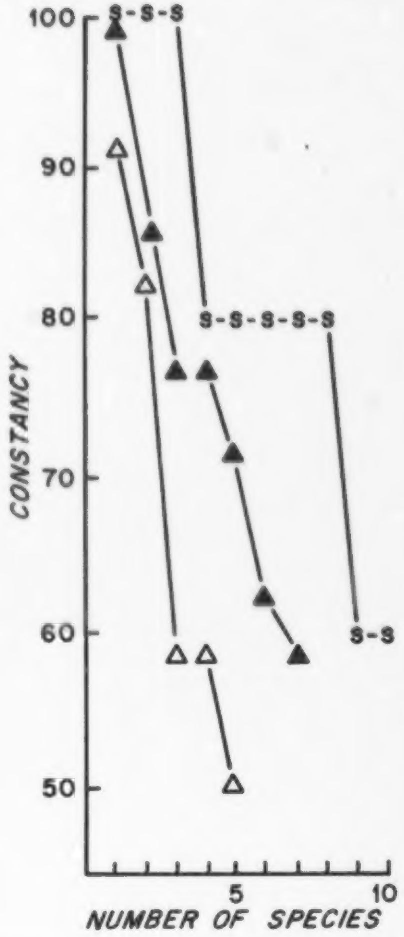


Figure 58. Constancies of species at stations 35, 20, 5, 10, 9, and 31.

Figure 59. Constancies of species at stations II and IV ++++ and the control station in Sippewissett Marsh.



constant at the control station. *Hydrobia totteni, Streblospio benedicti,* and *Edotea montosa* occurred in every sample from Sippewissett. Only *Capitella* occurred in every sample from station IV; the constancies of the species in the *Capitella capitata* group were lower (Grassle and Grassle, 1977). The most constant species at station II, *Hydrobia totteni,* was not in every sample. The sudden increase in numbers of *Capitella* in Sippewissett Marsh probably reflects invasion by this polychaete from a nearby test plot. *Gemma gemma* occurred in most samples from Sippewissett; in Wild Harbor River, however, this bivalve died soon after the spill, did not reappear for a year, and was thereafter infrequent and sparse. *Gemma gemma* broods its young, the young settle near the mother, and dispersal is relatively slow. Members of four major taxa were constant in Sippewissett Marsh; those of only two major taxa were constant in Wild Harbor River.

TABLE 8. ABSOLUTE AND RELATIVE NUMBERS OF SPECIES PRESENT IN MORE THAN 45% OF SAMPLES

Station	Total species	No. species with constancy >.45	% Species with constancy >.45
31	123	6	4.9
II	41	5	12.2
IV	51	7	13.7
9	148	29	19.6
10	182	34	18.7
5	149	44	29.5
20	147	47	32.0
35	145	47	32.4
Sipp.	30	10	33.3

Discrepancy Index

Values of the discrepancy index for the whole fauna at stations 31, 9, 10, 20, and 35 between the first and second years concur with the gradient of oil-induced stress (Figure 60). Values were least at the two stations farthest offshore, where concentrations of oil were lowest. Discrepancy was

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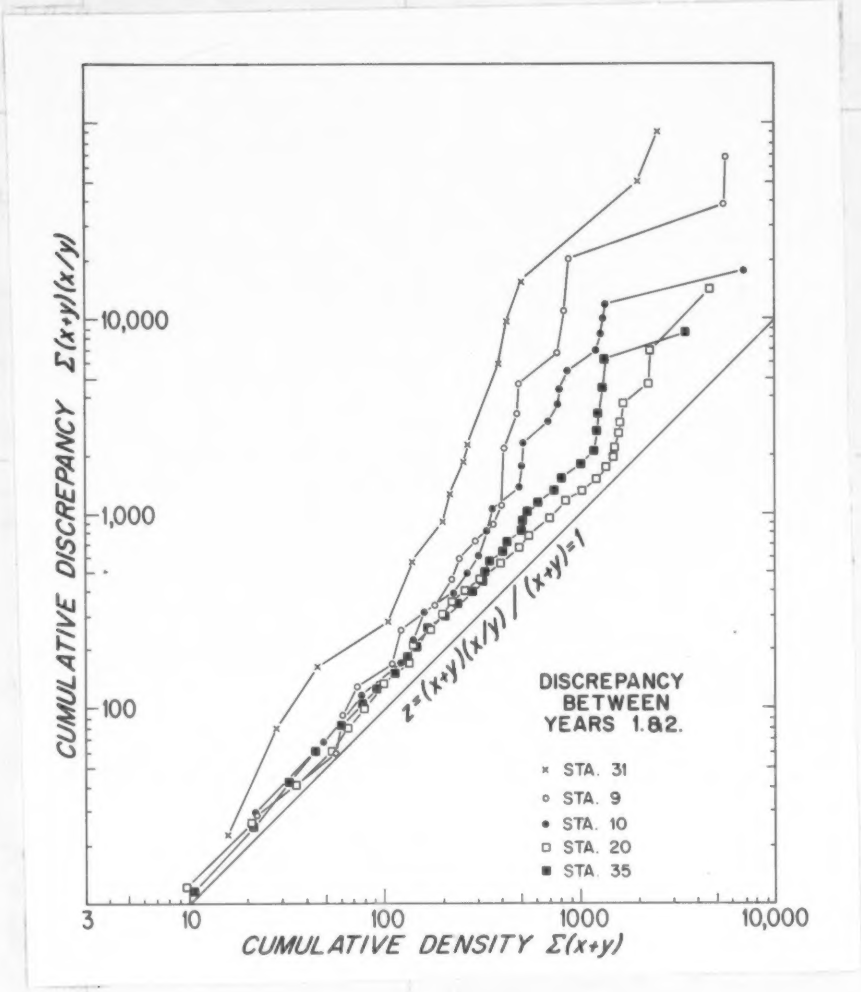

Figure 60. Discrepancy between the mean densities of the first and second years for species at stations 31, 9, 10, 20, and 35.

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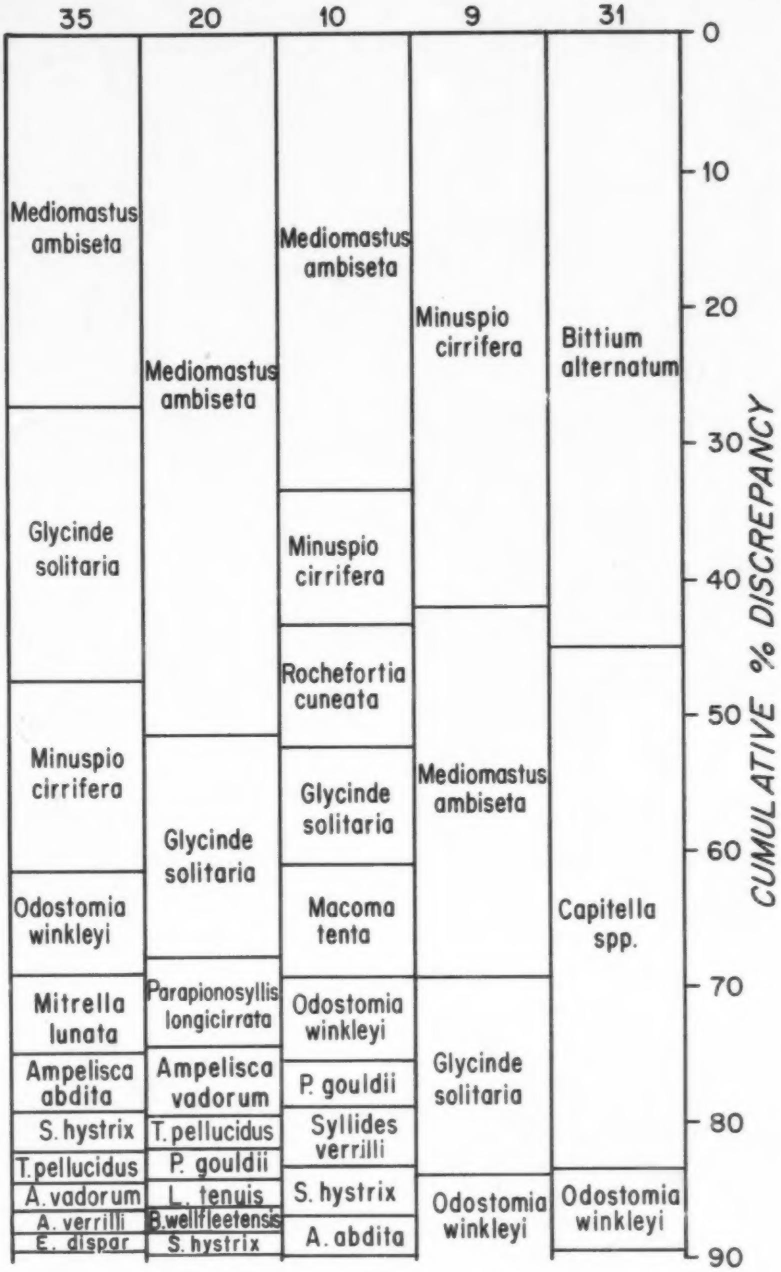

Figure 61. Species which together contributed almost 90% to discrepancy in mean densities of the first and second years at stations 31, 9, 10, 20, and 35.

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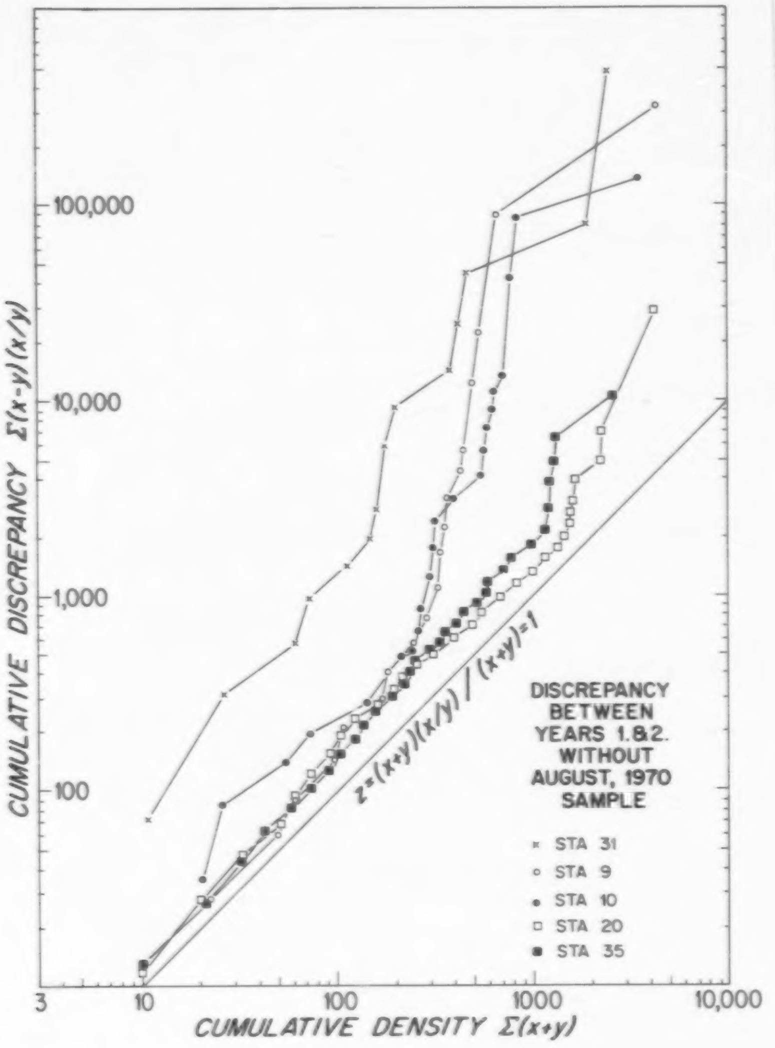

Figure 62. Discrepancy between the mean densities of the first and second years, without the August, 1970, samples, for species at stations 31, 9, 10, 20, and 35.

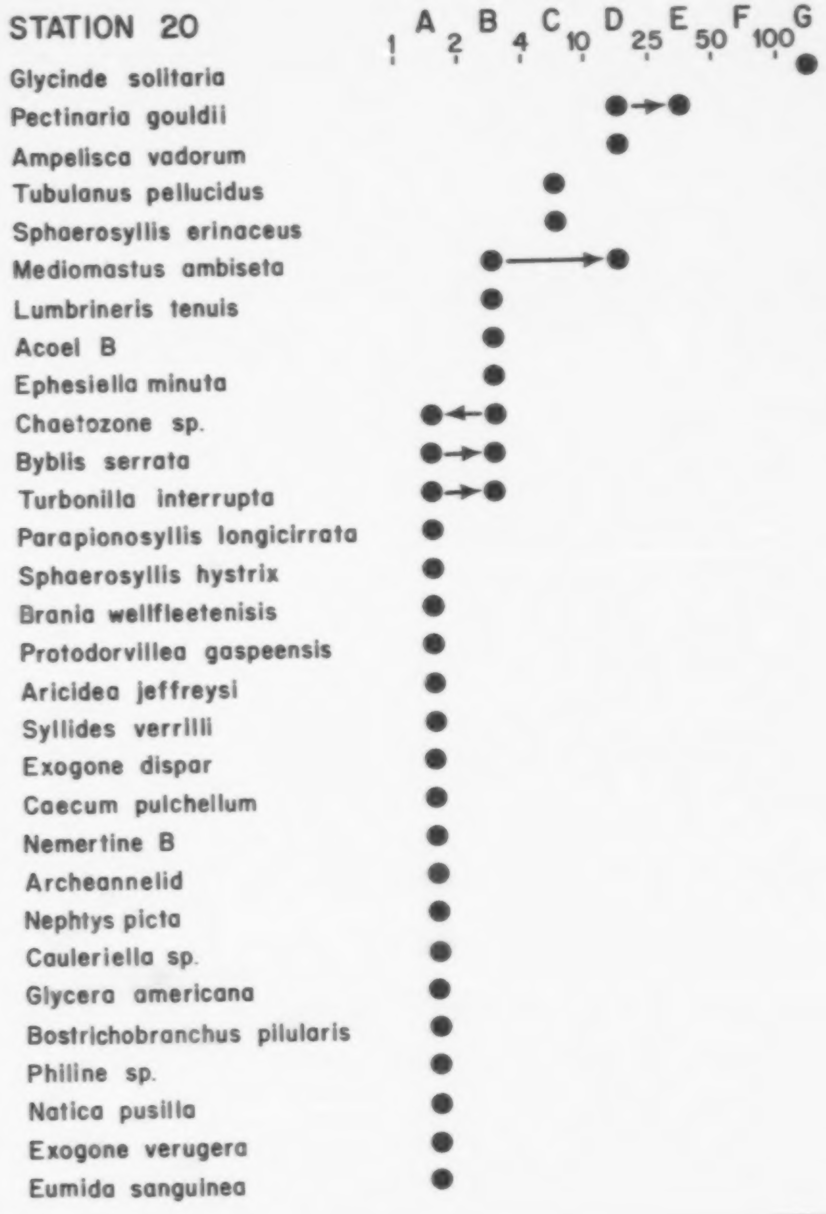

Figure 63. Changes in disparity (greater mean density divided by lesser mean density) between first and second year for species at station 20, upon omission of August, 1970, sample.

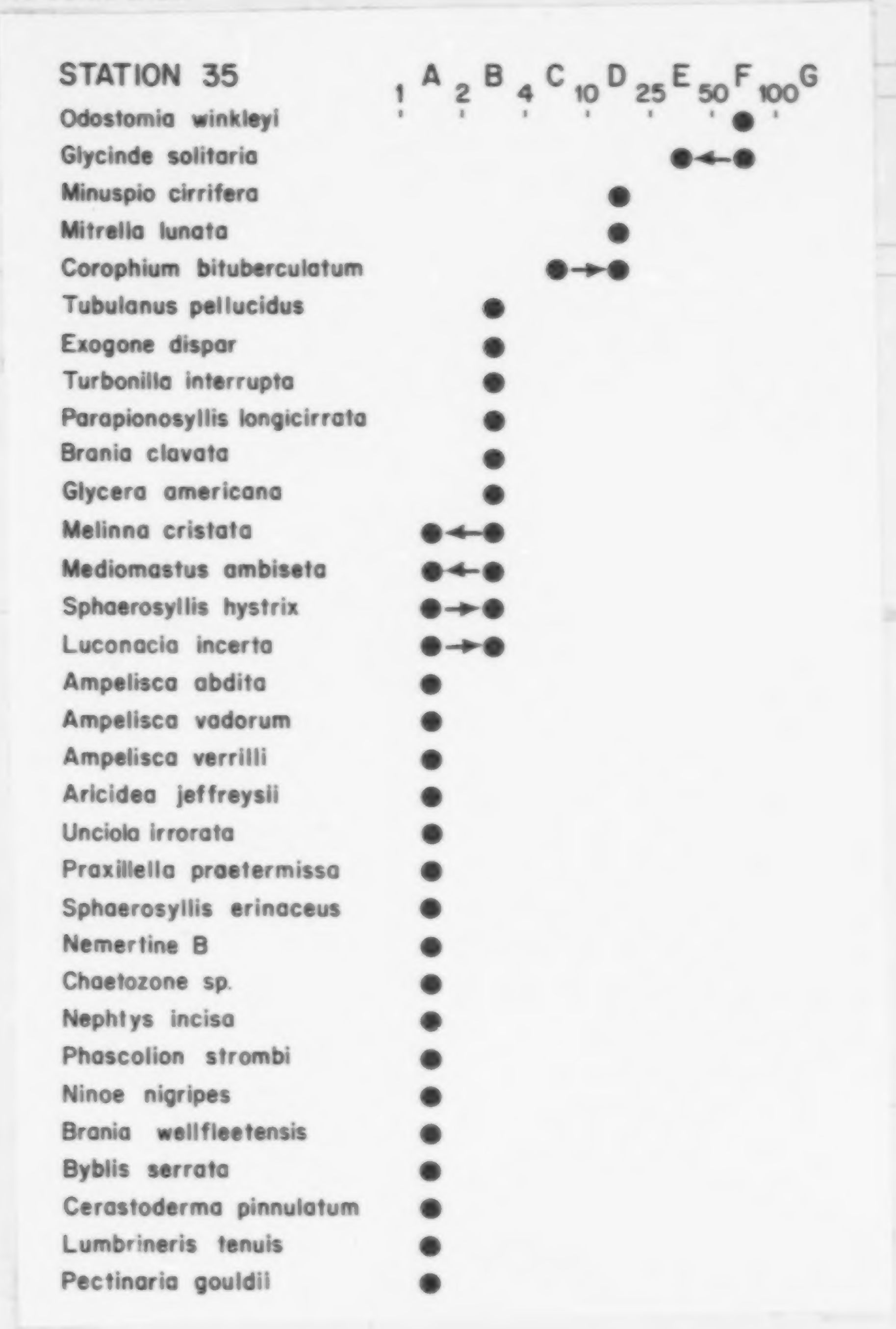

Figure 64. Changes in disparity (greater mean density divided by lesser mean density) between first and second year for species at station 35, upon omission of August, 1970, sample.

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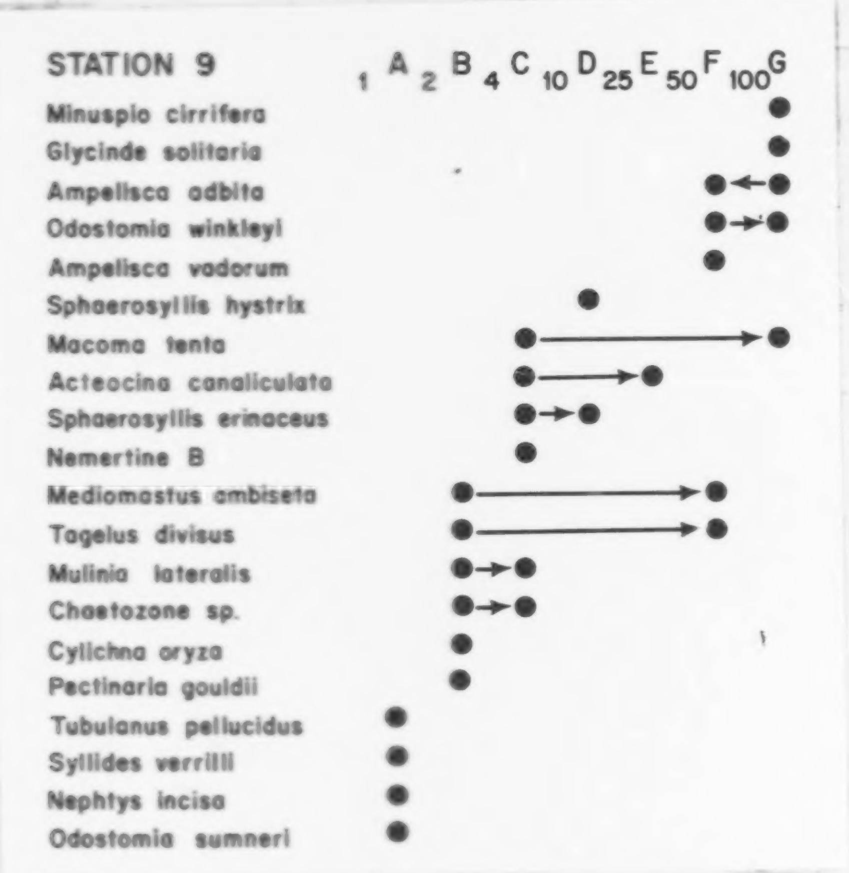

Figure 65. Changes in disparity (greater mean density divided by lesser mean density) between first and second year for species at station 9, upon omission of August, 1970, sample.

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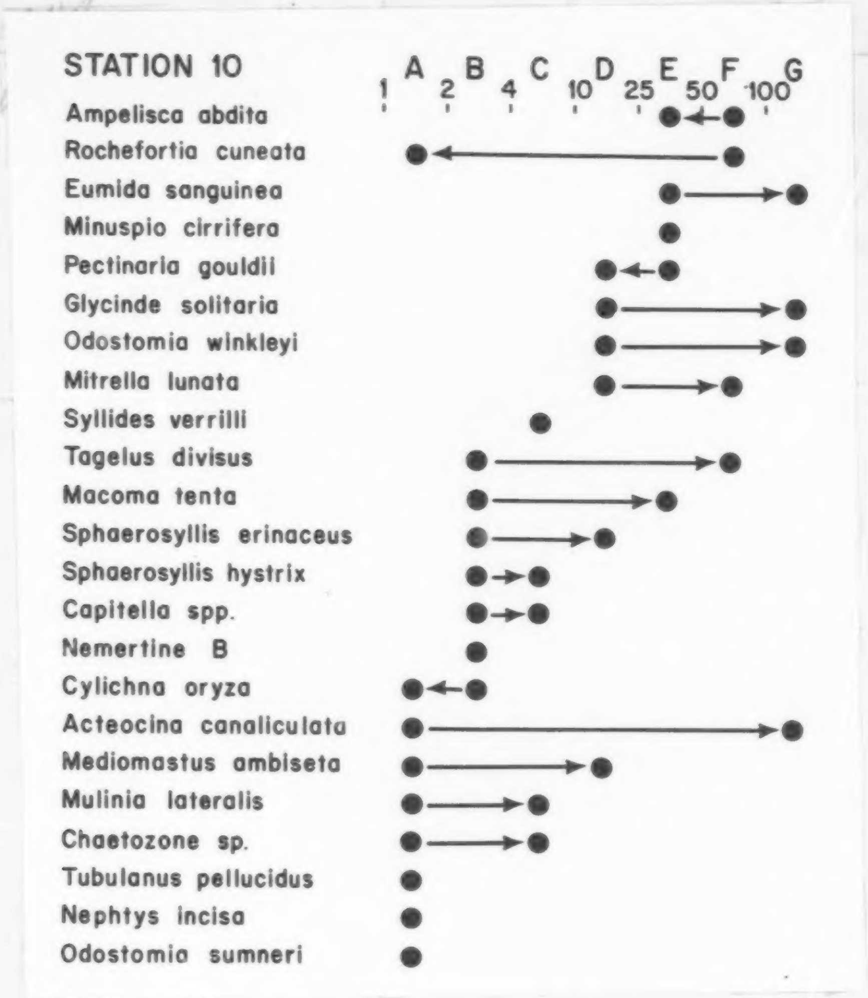

Figure 66. Changes in disparity (greater mean density divided by lesser mean density) between first and second year for species at station 10, upon omission of August, 1970, sample.

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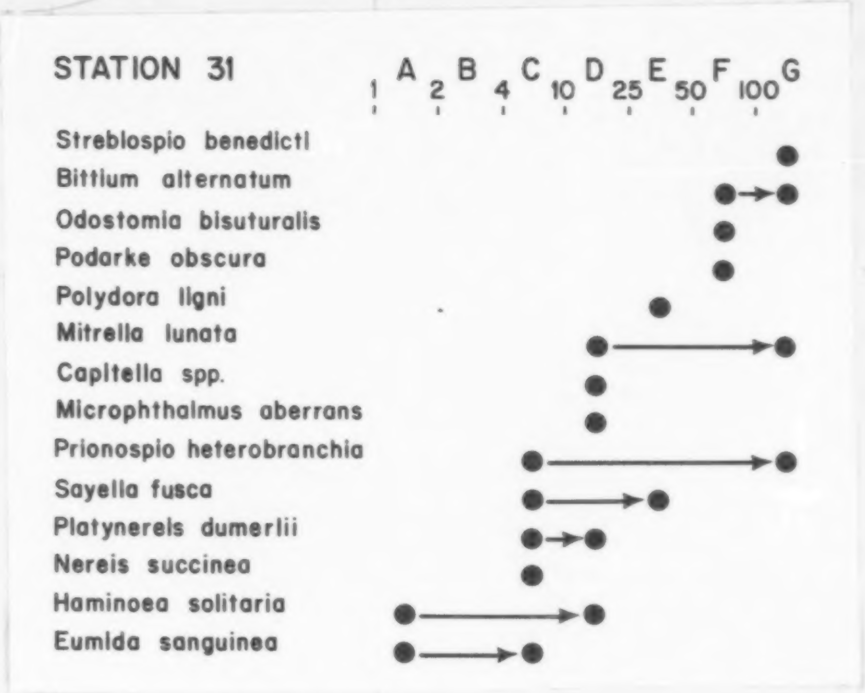

Figure 67. Changes in disparity (greater mean density divided by lesser mean density) between the first and second year for species at station 31, upon omission of August, 1970, sample.

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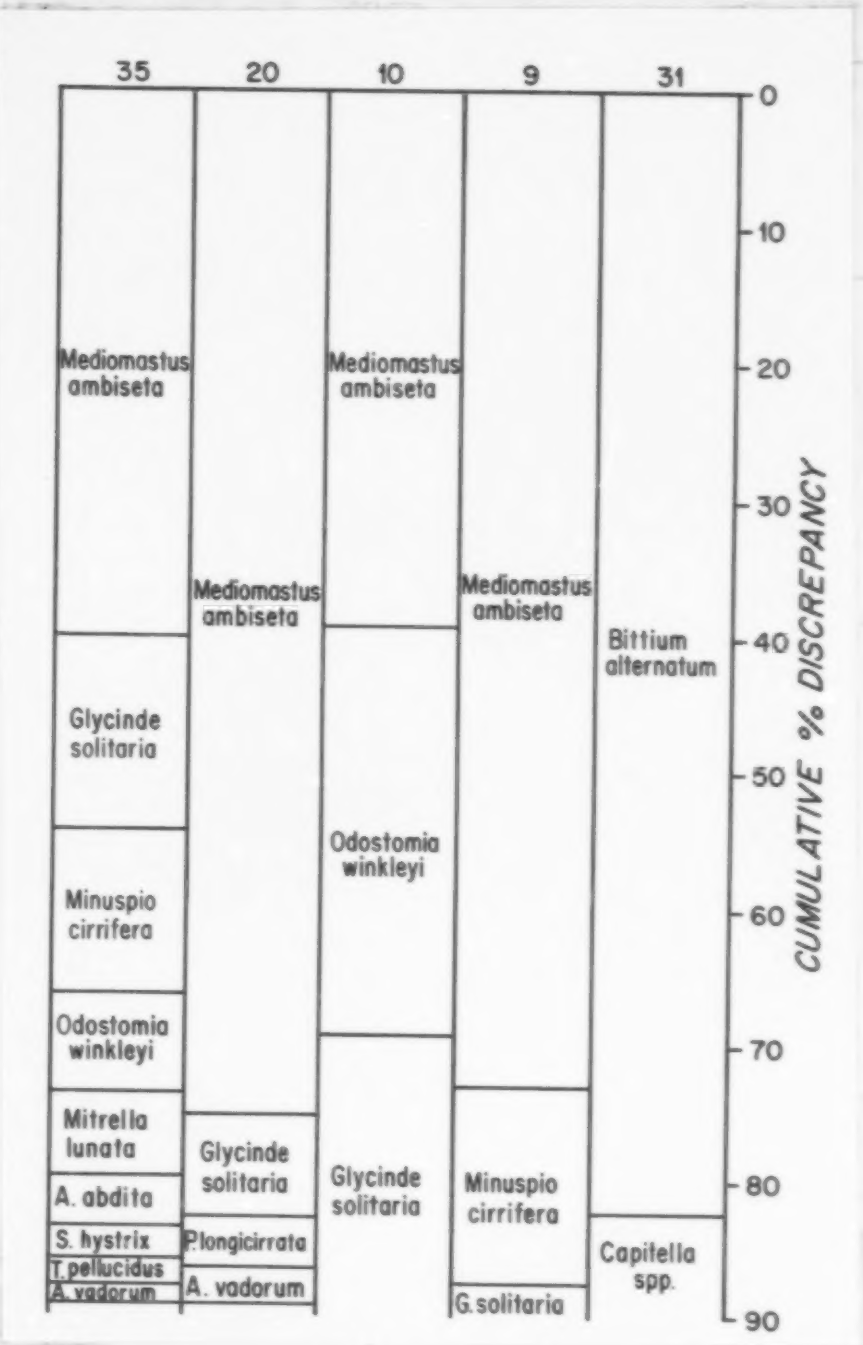

Figure 68. Species which together contributed almost 90% to the discrepancy in mean densities of the first and second years, without August, 1970, samples, at stations 31, 9, 10, 20, and 35.

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greater at intermediately oiled stations 9 and 10, and greatest at most heavily oiled station 31. Such pronounced differences relfect the large disparities not merely of the few very common species, but also of the numerous less common species.

The number of very discrepant species which together account for ninety percent of the total discrepancy is small at stations 31 and 9, but considerably larger at the other three stations (Figure 61). Amphipods, demonstrated to be sensitive to oil, were among the discrepant species at stations 20 and 35, but were absent from stations nearer shore. The discrepant species at station 31 were not those at the other four stations, which shared a suite of species, chief among which were *Mediomastus ambiseta, Glycinde solitaria, Minuspio cirrifera,* and *Odostomia winkleyi.*

The influx of juveniles in August, 1970, lowered values of the discrepancy index for the first two years, greatly at all of the more heavily oiled stations, but only slightly at the minimally oiled sites (Figure 62). The effect of the August, 1970, samples can be measured by placing, by station, each species for which the sum of the mean densities of the first two years was ten or more into one of seven categories of disparity. Wherever exclusion of the August, 1970, sample results in a change of category, an arrow shows the direction and magnitude of that change.

The majority of species at minimally oiled stations 20 and 35 (Figures 63, 64) are in the category of least disparity, A, some in the category of next smallest disparity, B, and only about one-sixth in categories of higher disparity. Most species at stations 9, 10, and 31, however, are in categories of intermediate or high disparity (Figures 65-67). Without the August, 1970, samples, disparity considerably increased at stations 9, 10, and 31, but increased only slightly at stations 20 and 35. The proportion of change which was to higher disparity was greatest at stations 31 and 9, somewhat less at stations 10 and 20, and least at station 35 (Table 9).

The very heavy settlement of the young of many species at intermediately oiled stations 9 and 10 in August, 1970, initiated the next phase of colonization, although other species also more abundant in the second year had not yet settled in great numbers. As these juveniles grew during the second year, they became crowded, and some species failed while others rapidly declined in numbers. At minimally oiled stations 20 and 35 juveniles of only one species, *Mediomastus ambiseta,* were numerous in August, 1970. The small differences in disparity with and without the August,1970, sample indicate that the fauna at these two stations changed relatively little from the first year to the second. In August, 1970, the fauna at these two offshore stations was similar in composition to that of both preceding and succeeding months. The proportion of the discrepancy index contributed by the four species common to stations 9, 10, 20, and 35 increased greatly at station 10, but only slightly at the other three stations (Figure 68). The number of very discrepant species was low at stations 9, 10, and 20, but fairly high at station 35.

At severely oiled station 31 density and faunal composition fluctuated rapidly and widely. These surges in species and numbers usually lasted from

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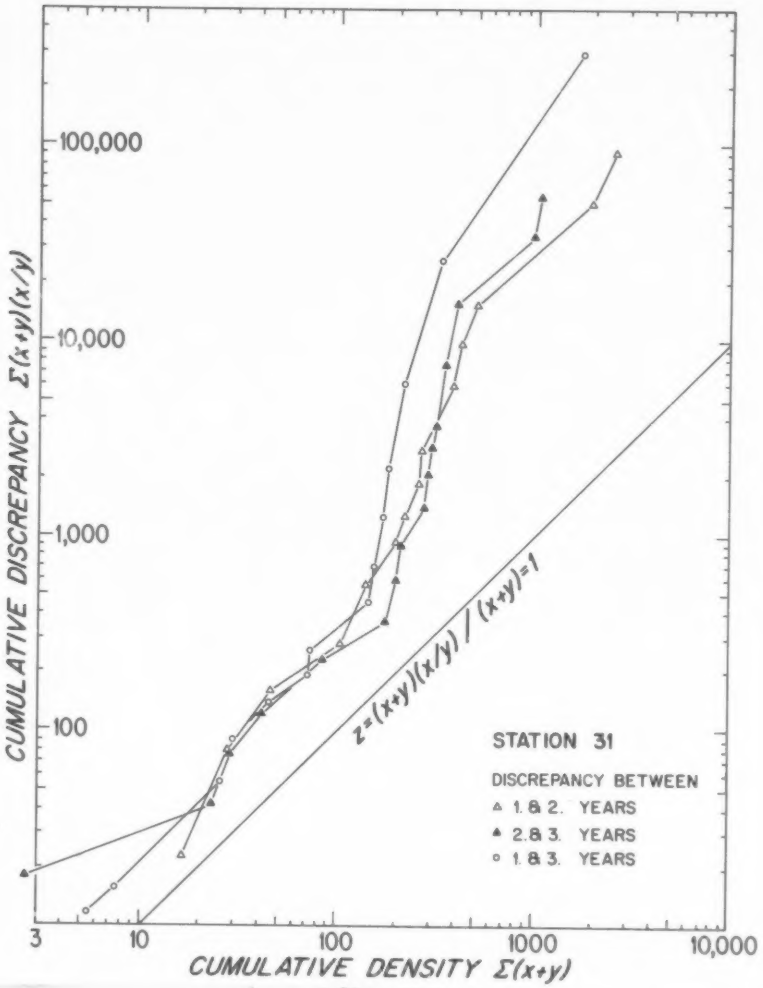

Figure 69. Discrepancies between mean densities of species of first and second, second and third, and first and third years at station 31.

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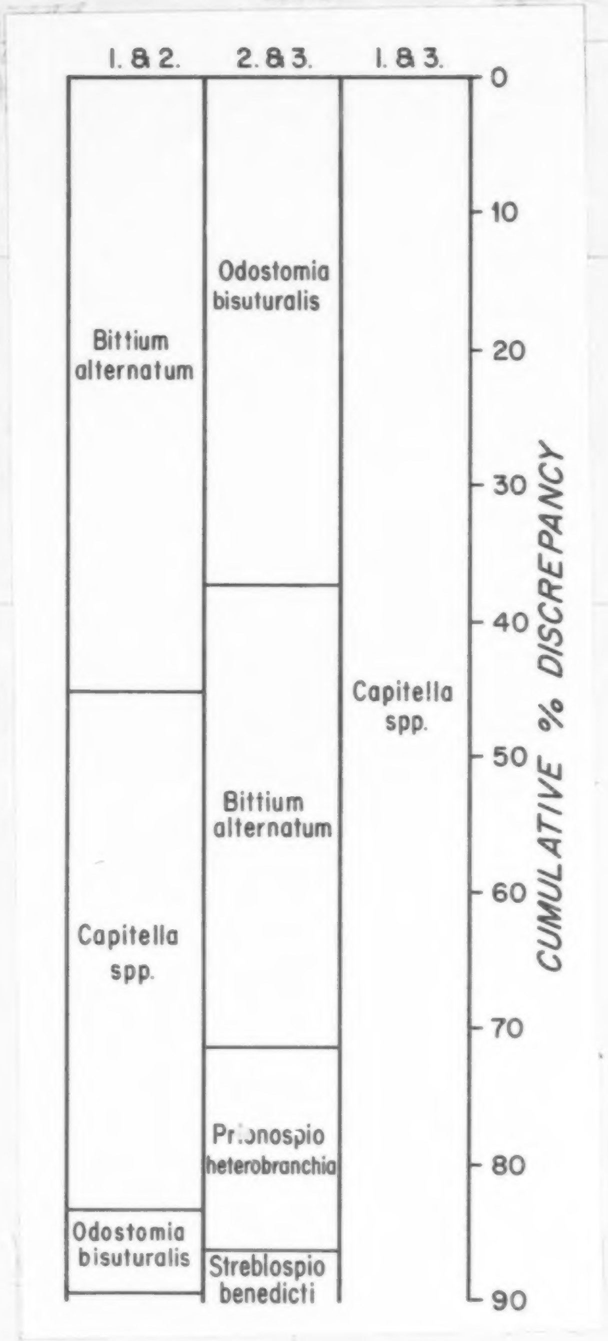

Figure 70. Species which together contributed almost 90% to discrepancy in mean densities of the first and second, second and third, and first and third years at station 31.

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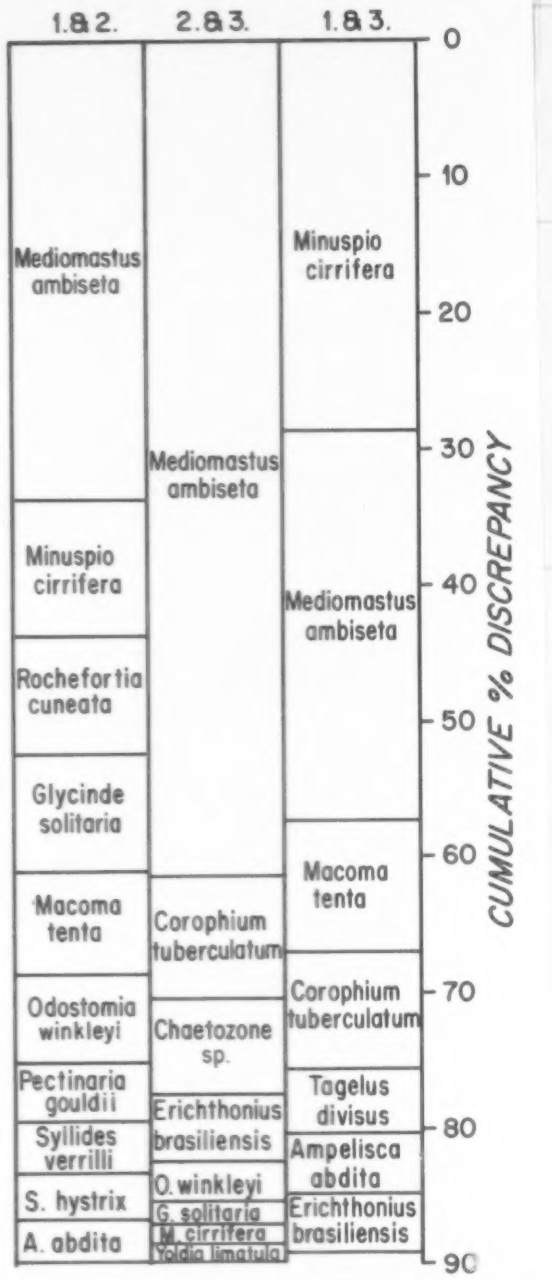

Figure 71. Species which together contributed about 90% to discrepancy in mean densities of the first and second, second and third, and first and third years at station 10.

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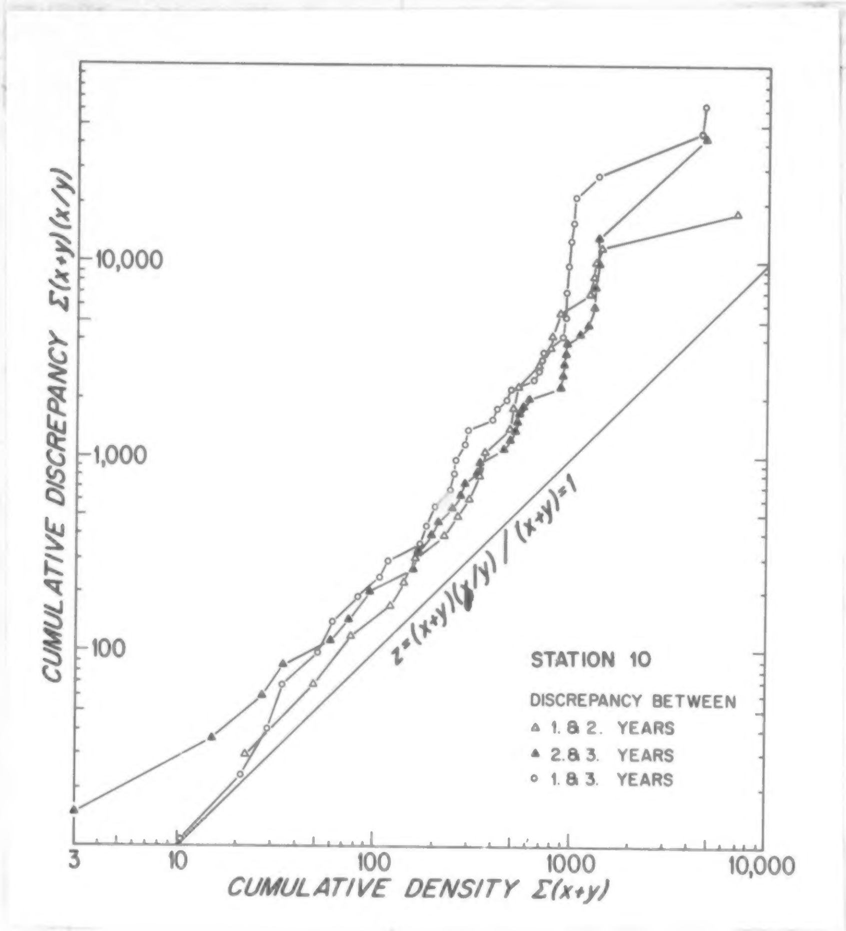

Figure 72. Discrepancies between mean densities of species of first and second, second and third, and first and third years at station 10.

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three to five months, although some were as brief as one month and others as long as nine months. In August, 1970, there was a major faunal shift from the dominants of the first year to some of those of the second. Although temporally adjacent samples differed in faunal composition, that of August, 1970, more closely resembled the succeeding samples.

TABLE 9. MEAN DISPARITY WITH AND WITHOUT THE AUGUST, 1970, SAMPLE; THE DIRECTION AND EXTENT OF CHANGE IN CATEGORY OF DISPARITY UPON OMISSION OF AUGUST, 1970 SAMPLE.

Station	No. species of requisite density	Mean rank all samples	% Species changing rank	Total change in rank	% Change to greater disparity	Net mean rank without Aug. 1970 sample
31	14	3.26	50	1.14	100	4.40
9	20	3.25	45	1.00	95	4.15
10	23	2.74	74	1.83	81	3.87
20	30	1.70	17	0.20	85	1.84
35	32	1.78	19	0.19	68	1.85

Enough samples taken in the third year at stations 31 and 10 were analyzed to warrant discussion. At station 31, discrepancies were quite high and indicative of considerable faunal variation during the three years (Figures 69). Like the uncommon species, the dominants came to a brief climax in only one of the three years, and the suite of dominants changed from one year to the next. At both stations 31 and 10, the number of very discrepant species did not change very much with the passage of time (Figures 70, 71). After three years the fauna at station 31 had only slightly recovered. Mean densities at intermediately oiled station 10 (Figure 72) for the three years were fairly similar to one another, and the values of the index were generally much lower there than at station 31. Almost all the specimens of *Mediomastus ambiseta* found in later months arrived as juveniles during the very heavy settlement in August, 1970. The abundance of this polychaete was almost the sole cause of the low discrepancy between the first two years. The discrepancy was less, although in some cases only slightly so, between the second and third years at all densities greater than 500. The faunas of the first and third years were the least similar. The fact that the fauna of the second year resembled that of the third year indicates that the fauna was recovering. This discrepancy between the second and third years at station 10 is markedly greater at all cumulative densities save the very smallest than the discrepancy between the first and second years at minimally oiled stations 20 and 35. The fauna at station 10, therefore, showed only slight recovery three years after the spill.

Diversity

We describe diversity in terms of the Hurlbert rarefaction curves, and note differences between the results of this index and those yielded by the Shannon-Wiener information function.

On September 19, 1969, the fauna at station 31 was about as diverse (Figures 73, 74) as that at station 35 in the first year after the spill. Within a week, diversity fell to a very low level, and continued to decline through the winter of 1969-70, when *Capitella* and five other species were abundant. Evenness (Figure 75) was artificially high in September and October, 1969, when density was too low to allow expression of possible dominance. During the autumn and winter of 1969-70, evenness fell to its lowest value. After March, 1970, diversity slowly rose, although it was still very low. During the first year diversity was fairly variable, especially in the early months. Evenness fluctuated and slowly increased during the latter half of the first year. In August, 1970, diversity and evenness increased considerably with the settlement of juveniles of many species. In the second year diversity and evenness were lowest in winter, when four species of gastropods were subdominant and density was low. During the second year, evenness and diversity fluctuated widely and rapidly, and slowly increased. In the season of recruitment of 1971, three species were subdominant; evenness was moderate and diversity fairly high. Thereafter, density was so low that values of the information function and evenness index based on 1/25 m^2 samples were invalid. After three and one-half years, evenness and diversity measured by rarefaction failed to rise to the level found three days after the spill. Diversity measured by the less sensitive information function would suggest a degree of recovery greater than that indicated by rarefaction curves.

During the first year the abundance of *Capitella* at station 31 depressed diversity and evenness. The fauna without this polychaete was apparently diverse (Figure 76), but density was very low. Only in June, July, and August, 1970, was the fauna without *Capitella* dense enough to ensure statistical validity. For the first year as a whole, evenness decreased and diversity, after the initial drop, slowly increased. Both fluctuated widely. Evenness and diversity of the fauna without *Capitella* rose in August, 1970. *Capitella* soon crashed; the curves of the rest of the fauna are thereafter essentially those of the whole fauna.

Values of evenness and diversity for the first nine months at station 9 were deceptively high, regardless of index (Figures 77-79), because density was very low. According to the information function, diversity decreased in the winter of 1969-70. The low value of the information function for April, 1970, partly reflects the increased dominance of *Mediomastus*. In June, 1970, diversity and evenness fell rapidly, but not to the very low values prevalent at station 31. Owing to the dominance of *Mediomastus* diversity according to the information function was least in the following month. Diversity was very variable in the first year. Diversity remained low for about nine months, then rose fairly rapidly in the spring and summer of 1971, and reached

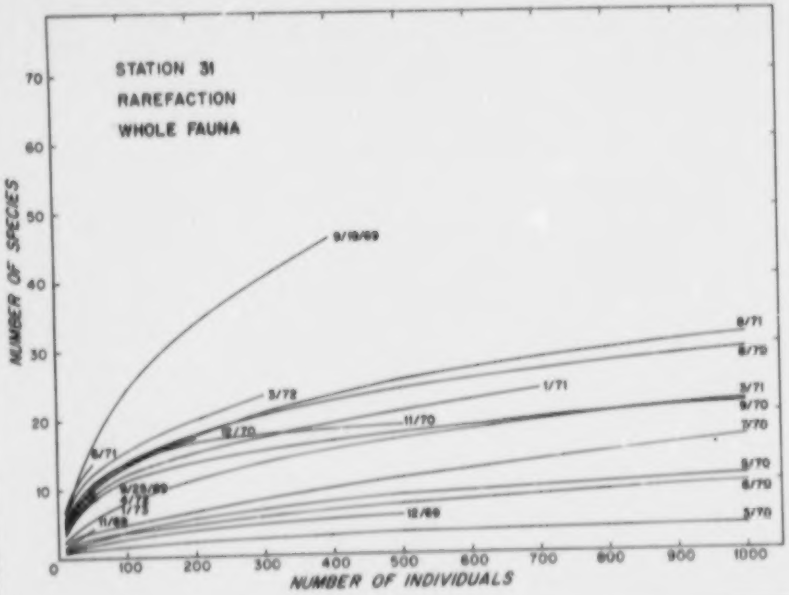

Figure 73. Diversity of the whole fauna at station 31, according to the Hurlbert rarefaction method.

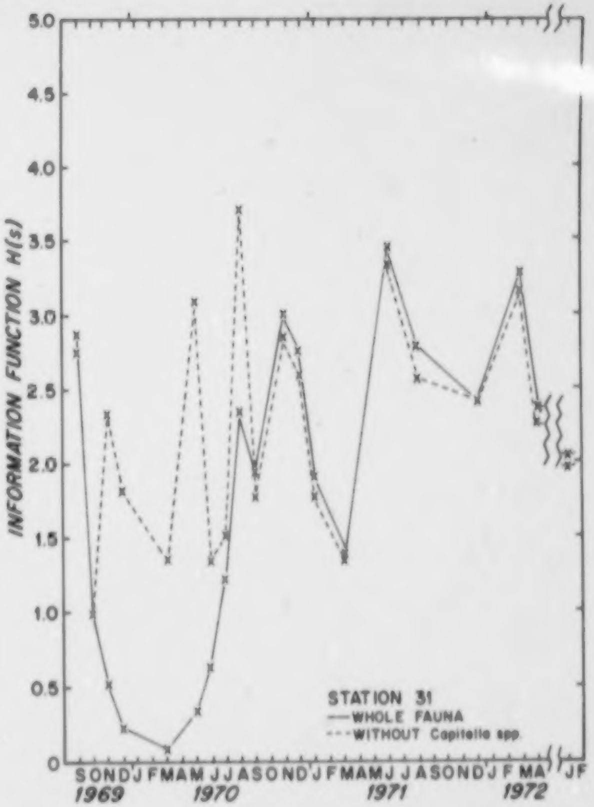

Figure 74. Diversity of the fauna with and without *Capitella* at station 31, according to the Shannon-Wiener information function.

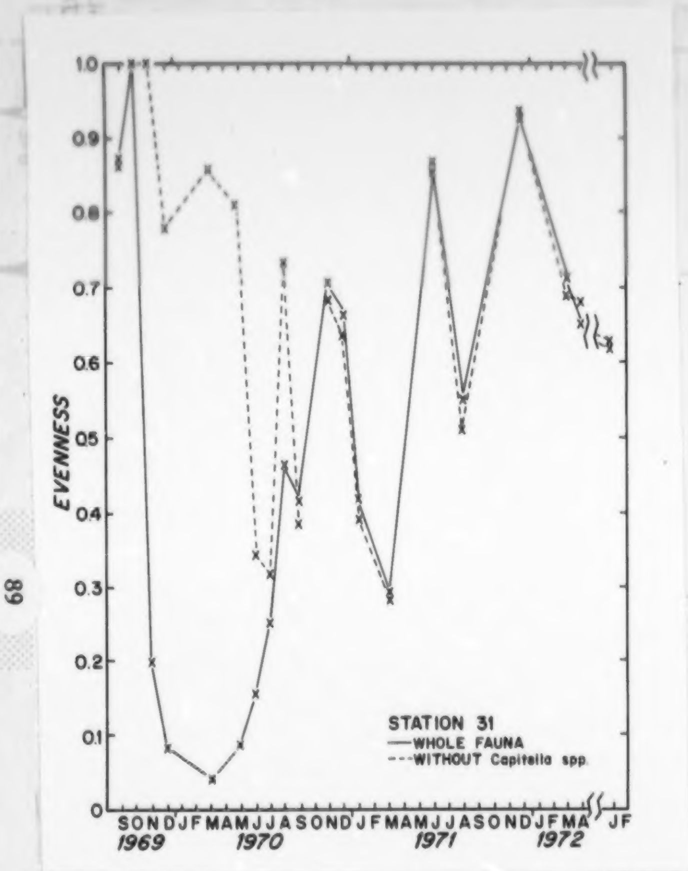

Figure 75. Evenness of the fauna with and without *Capitella* at station 31.

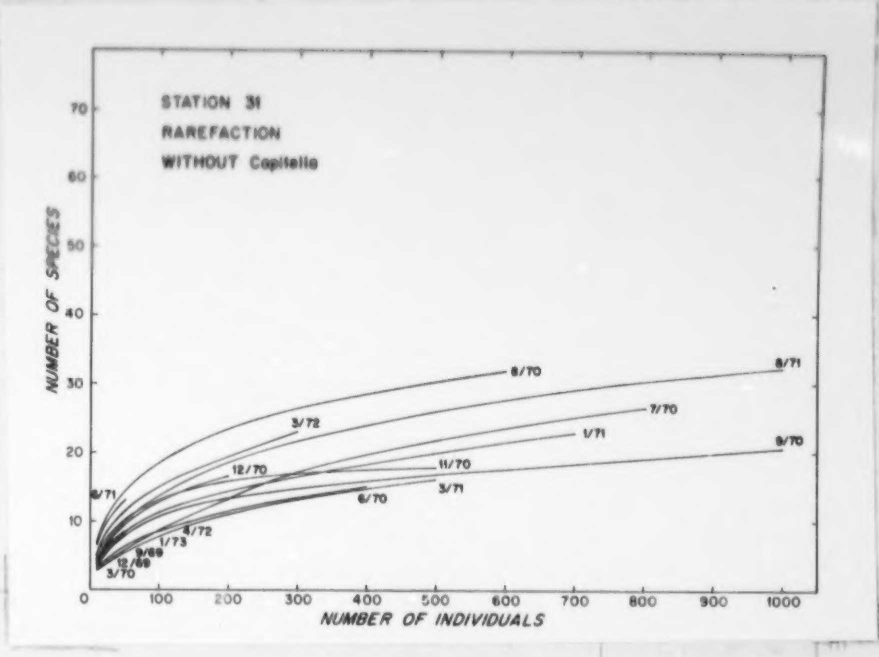

Figure 76. Diversity of the fauna without *Capitella* at station 31, according to the Hurlbert rarefaction method.

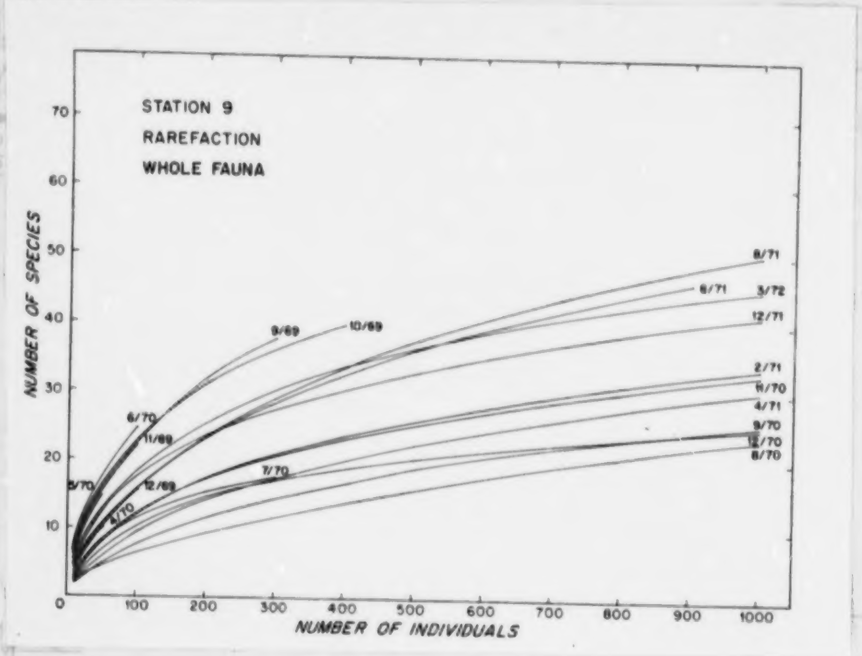

Figure 77. Diversity of the whole fauna at station 9, according to the Hurlbert rarefaction method.

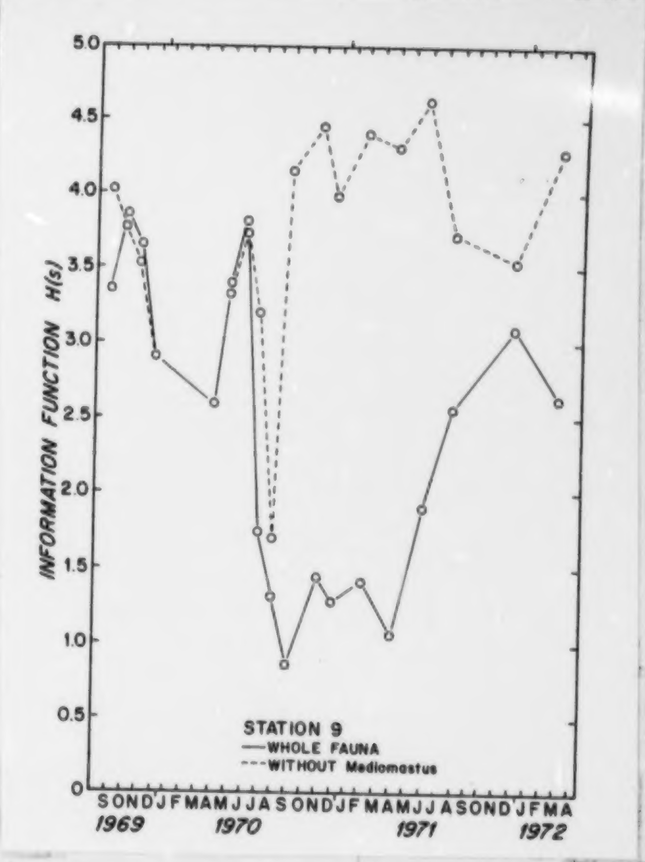

Figure 78. Diversity of the fauna with and without *Mediomastus* at station 9, according to the Shannon-Wiener information function.

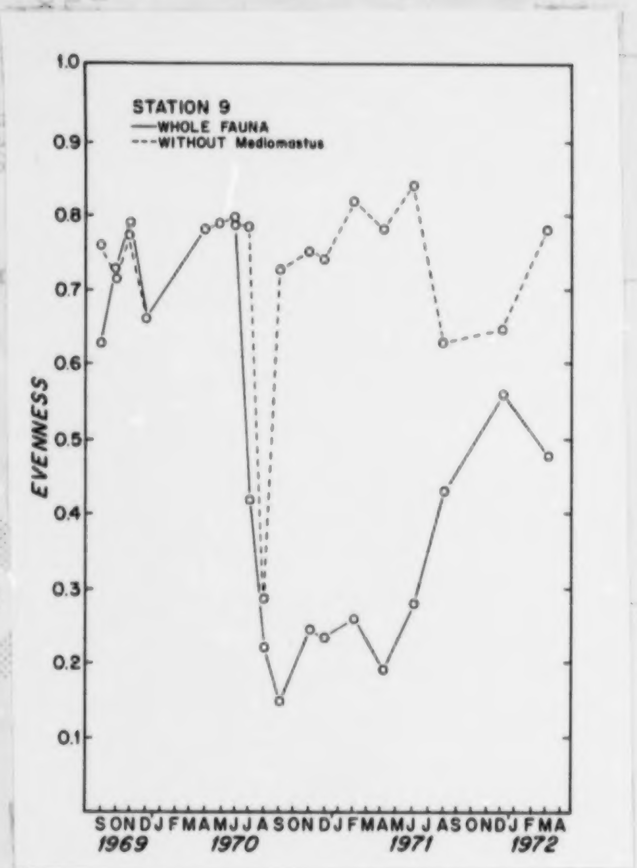

Figure 79. Evenness of the fauna with and without *Mediomastus* at station 9.

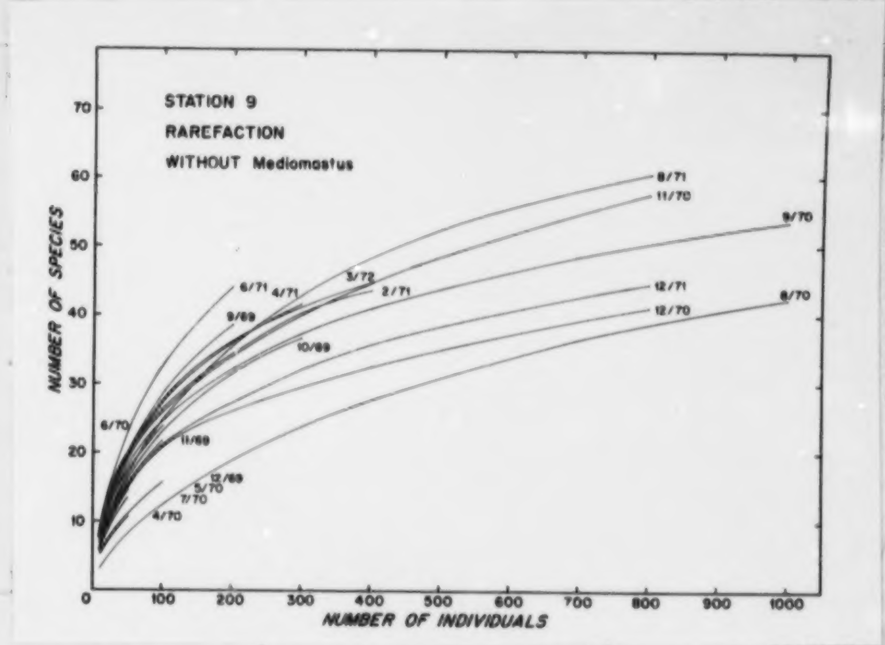

Figure 80. Diversity of the fauna without *Mediomastus* at station 9, according to the Hurlbert rarefaction method.

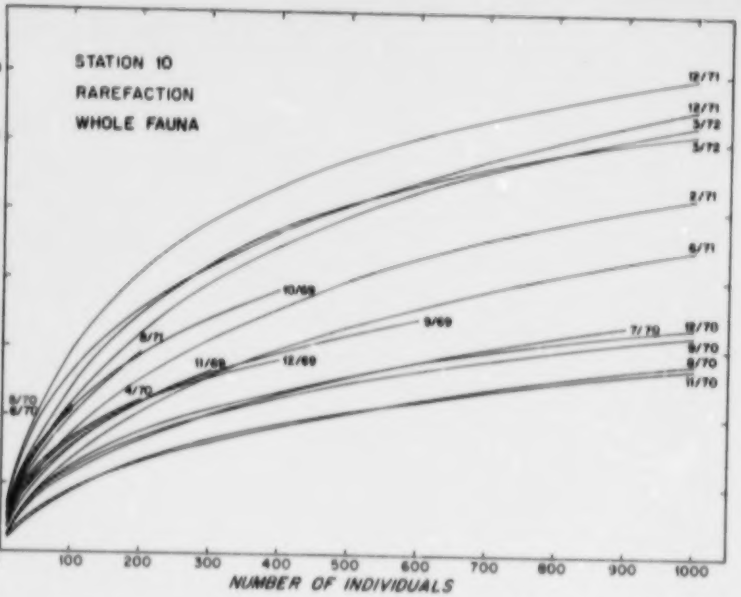

Figure 81. Diversity of the whole fauna at station 10, according to the Hurlbert rarefaction method. Replicate samples taken Devember, 1971, and March, 1972, were analyzed.

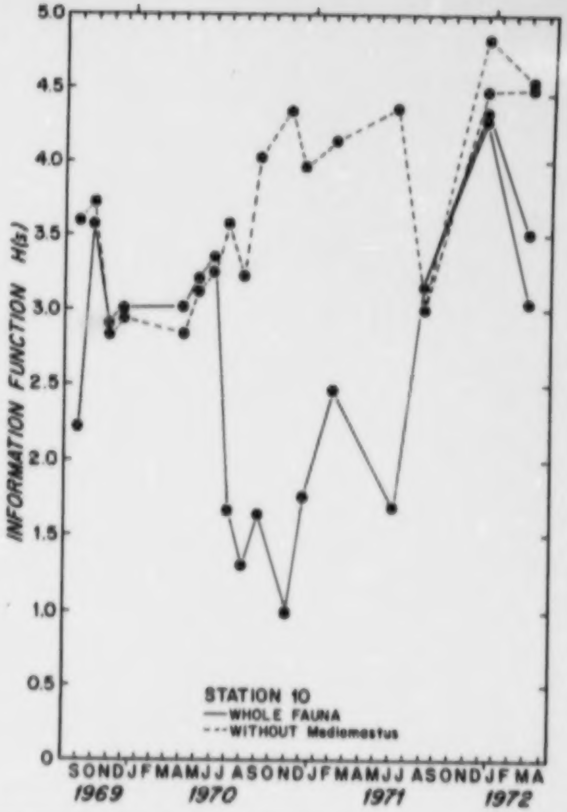

Figure 82. Diversity of the fauna with and without *Mediomastus* at station 10, according to the Shannon-Wiener information function. Bifurcation of lines indicates replicate samples.

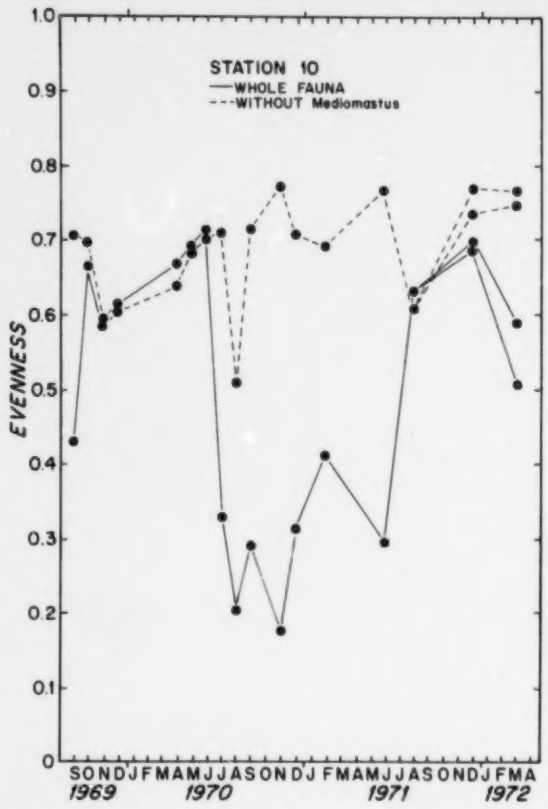

Figure 83. Evenness of the fauna with and without *Mediomastus* at station 10. Bifurcation of lines indicates replicate samples.

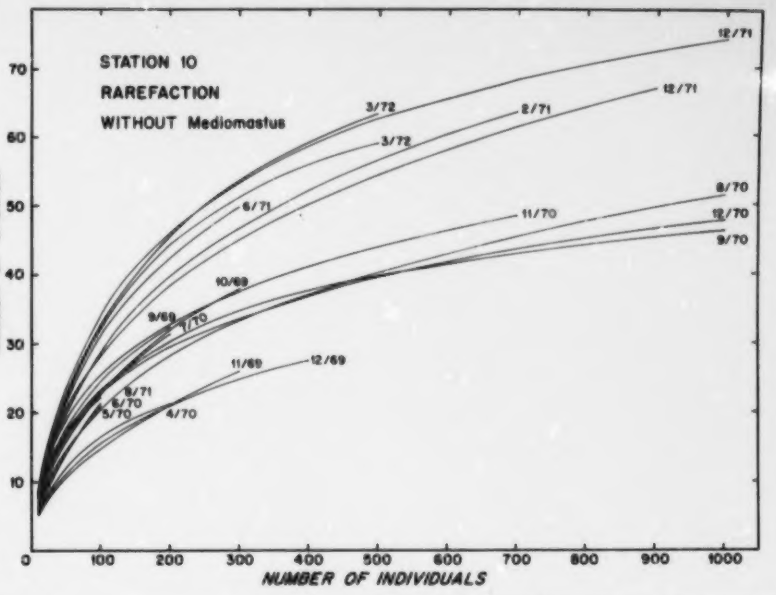

Figure 84. Diversity of the fauna without *Mediomastus* at station 10, according to the Hurlbert rarefaction method. Replicate samples taken December, 1971, and March, 1972, were analyzed.

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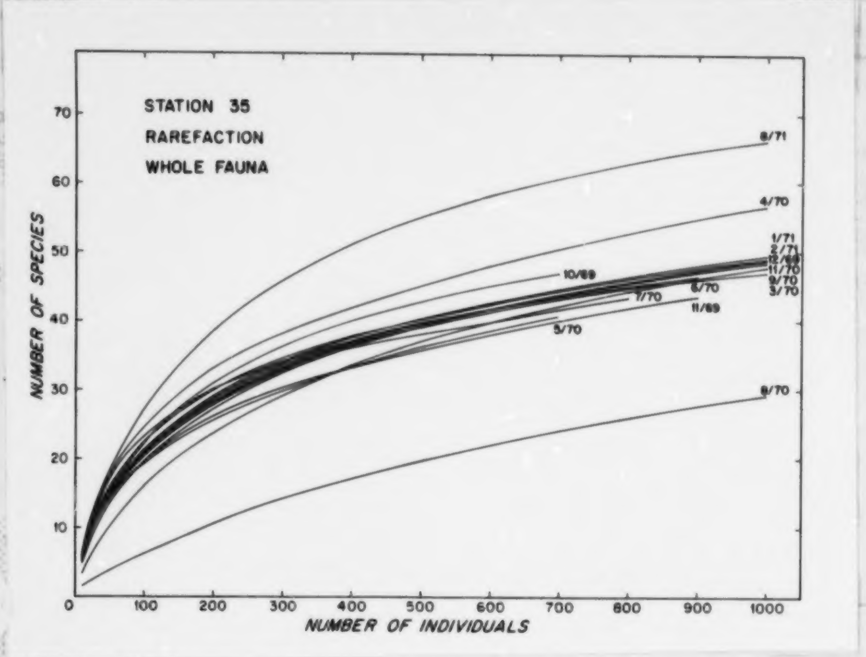

Figure 85. Diversity of the whole fauna at station 35, according to the Hurlbert rarefaction method.

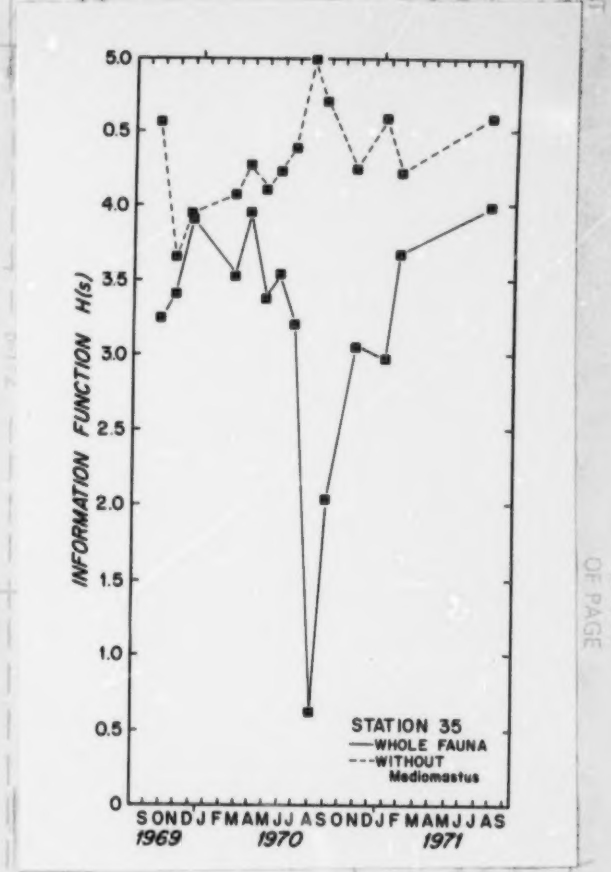

Figure 86. Diversity of the fauna with and without *Mediomastus* at station 35, according to the Shannon-Wiener information function.

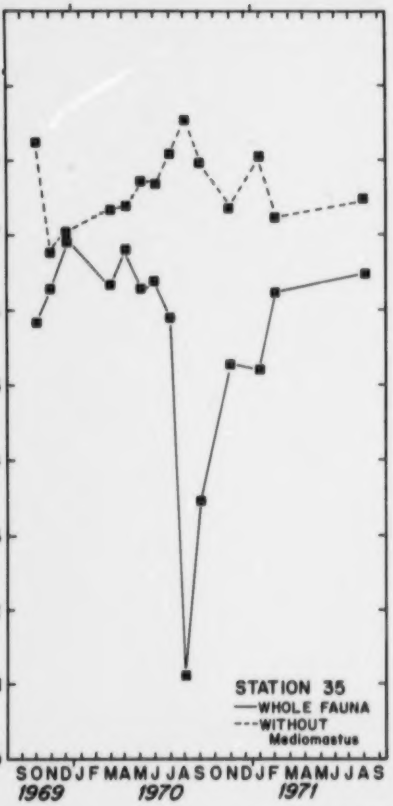

Figure 87. Evenness of the fauna with and without *Mediomastus* at station 35.

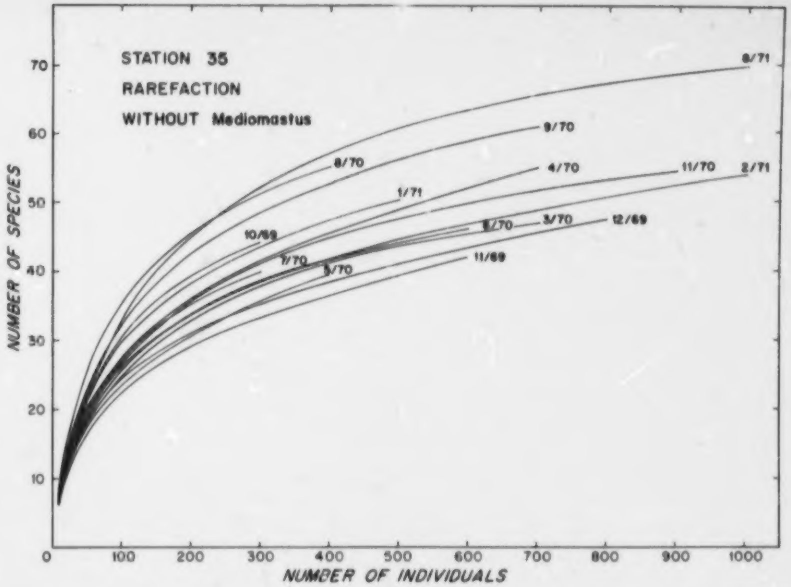

Figure 88. Diversity of the fauna without *Mediomastus* at station 35, according to the Hurlbert rarefaction method.

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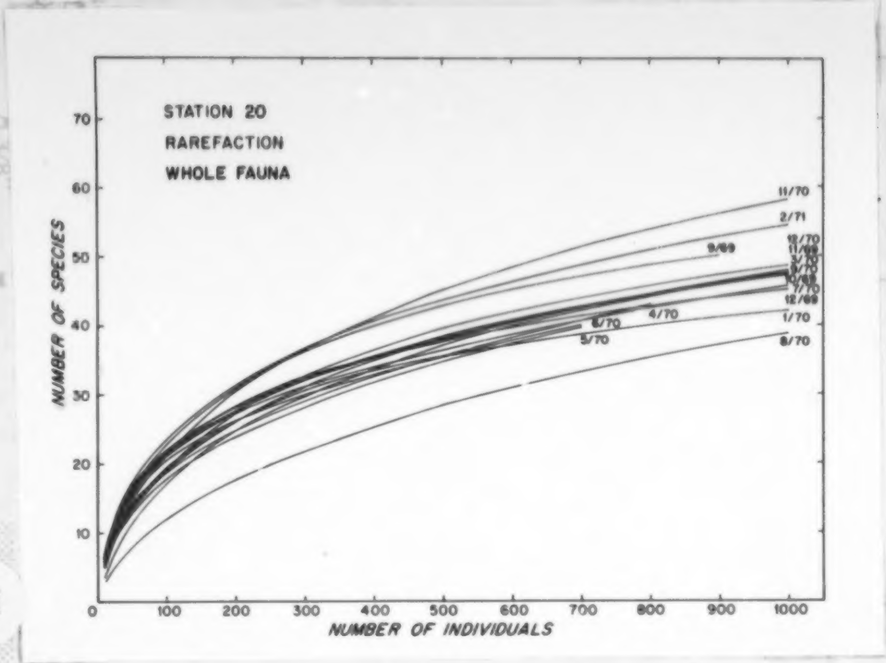

Figure 89. Diversity of the whole fauna at station 20, according to the Hurlbert rarefaction method.

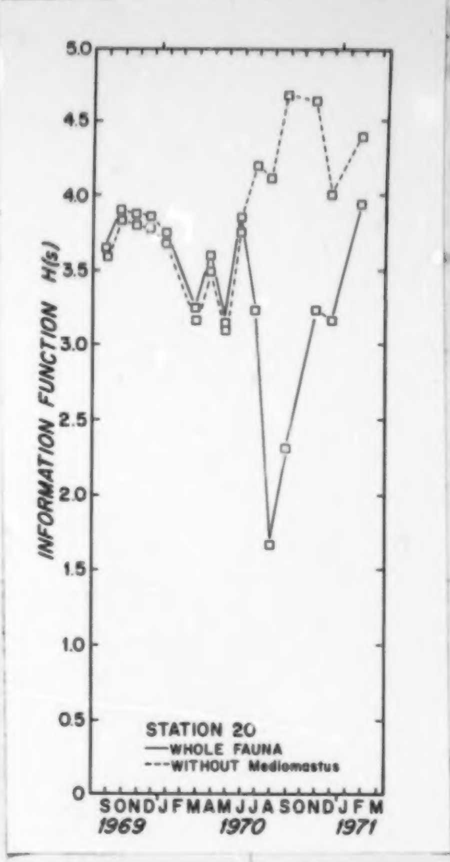

Figure 90. Diversity of the fauna with and without *Mediomastus* at station 20, according to the Shannon-Wiener information function.

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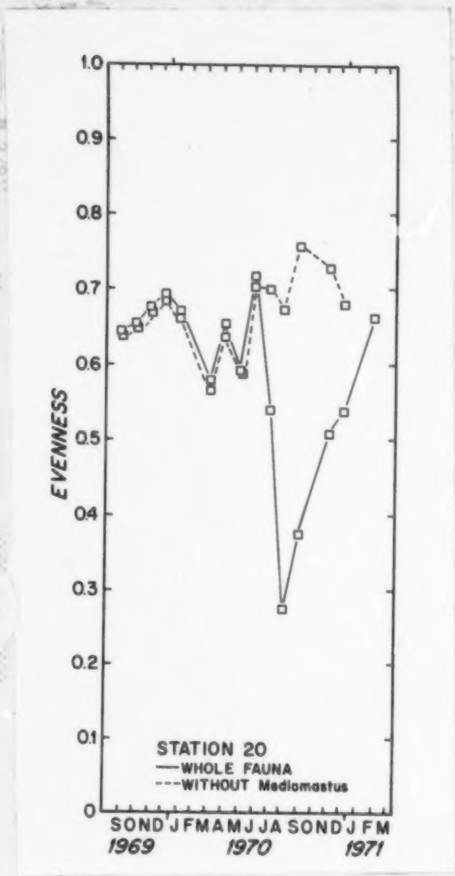

Figure 91. Evenness of the fauna with and without *Mediomastus* at station 20.

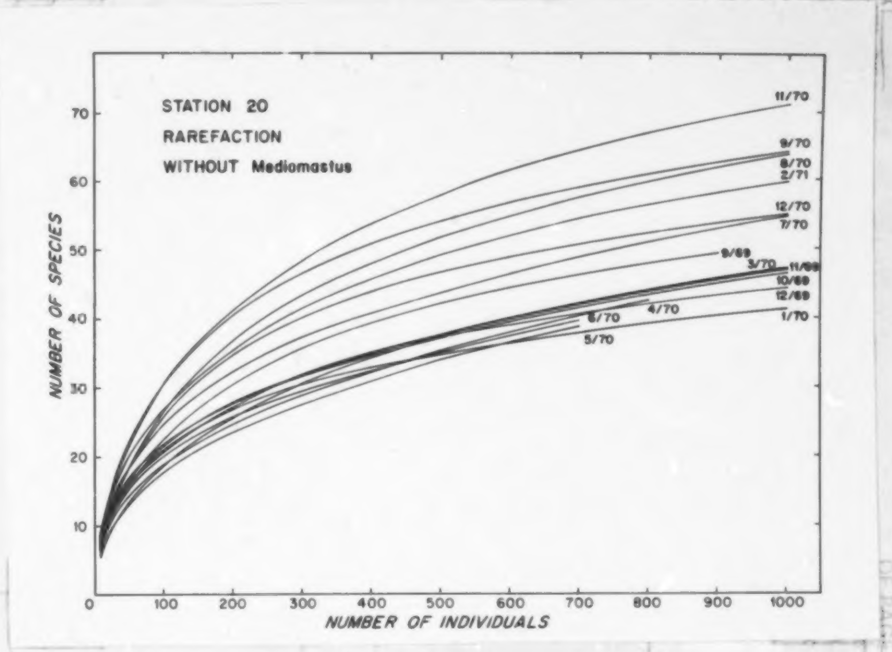

Figure 92. Diversity of the fauna without *Mediomastus* at station 20, according to the Hurlbert rarefaction method.

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moderate values in the winter of 1971-72. Neither diversity nor evenness rose to values prevalent shortly after the spill. Diversity was quite variable in the second year.

Without *Mediomastus*, densities at station 9 were extremely low in the first year, and diversity and evenness were artificially high (Figure 80). In August, 1970, the rest of the species were fairly evenly represented. During the second year diversity and evenness of the fauna without *Mediomastus* quickly recovered from the depression of August, 1970, and thereafter were fairly high and rapidly fluctuating. Diversity and evenness fell in the late summer and autumn of 1971, rather than in the winter.

At station 10, density was very low in the first ten months; both evenness and diversity were artificially high (Figures 81-83). In July, 1970, diversity and evenness decreased abruptly and remained low until August, 1971. Diversity according to rarefaction fluctuated more here in the first year than at station 9, although the information function suggests lesser fluctuations at station 10. Diversity and evenness perhaps began to recover slightly sooner that at station 9. Fluctuations of diversity and evenness in the second year were of greater magnitude here than at station 9.

Without *Mediomastus* the drop in diversity (Figure 84) and evenness at station 10 in the autumn and winter of 1969-70 was somewhat more evident. For the next fourteen months diversity of the fauna without this polychaete slowly rose with some fluctuation to fairly high values in June, 1971. Evenness and diversity decreased in August, 1971, but soon rose to fairly high levels. During these fourteen months, fluctuations of diversity and evenness were rapid, but less broad than those of the whole fauna. After two and one-half years, values of diversity and evenness had risen above initial levels, but were still fluctuating.

At station 35 diversity was at first fairly high and evenness moderate (Figures 85-87). Both fluctuated slightly in the earlier months of the first year, but little thereafter. In early and mid-summer of 1970, both diversity and evenness decreased, but soon recovered. According to rarefaction this recovery was complete in little more than a month; the information function suggests that this recovery took six months. In August, 1971, diversity increased.

Without *Mediomastus* diversity at station 35 was higher, especially in the second year (Figure 88). The autumnal-hibernal decrease in diversity was very slight in the first year, and not clearly evident in the second. Diversity was high in August, 1971. Variations in diversity and evenness were moderate to slight, and seemingly diminished in amplitude with the passage of time.

At station 20 diversity was about as high as that at station 35, but much less variable (Figures 89, 90). In the first year there was only a slight hibernal-vernal decline in diversity. The decline in August, 1970, was modest. Within a month, according to rarefaction, diversity not only had recovered, but had increased above former levels. According to the information function, recovery of diversity took about three months. Evenness

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(Figure 91), which also decreased in August, 1970, recovered in about six months.

According to the rarefaction curves (Figure 92), diversity of the fauna without *Mediomastus* was somewhat more variable than that of the whole fauna at station 20. Diversity and evenness were lowest in the late winter and early spring of 1970, and rose during the following summer and autumn, a year after the spill, to levels higher than those prevalent in the first month.

Relative Contributions of Species Richness and Evenness to Diversity

At station 31, evenness contributed more to the low diversity of the whole fauna than did species richness (Figure 93), although both were low. Without *Capitella*, both low evenness and slight species richness depressed diversity (Figure 94).

At stations 9 and 10 evenness generally raised the diversity of the whole fauna in the first eleven months (Figures 95, 96). In the month of the spill, species richness was low enough to depress diversity at station 9; at station 10, evenness was only slightly more important than species richness. After July, 1970, species richness was usually somewhat greater than evenness at station 9. The dominance of *Mediomastus* during the summer of 1970 concealed the increase in evenness and species richness of the rest of the fauna at both stations. In August, 1970, the recent spatfall of *Macoma tenta* greatly decreased evenness, and lowered diversity at both stations 9 and 10. In that month, evenness was slightly greater than species richness at station 9, but slightly less at station 10. At station 10, settlement of myriads of many species already present in low densities lowered both evenness and species richness in that same month, and therefore lowered diversity. In the second year at station 10, the influence of species richness on diversity was somewhat greater than that of evenness. At this station in the third year species richness was usually more important than evenness.

Because evenness increased more than species richness decreased at station 9 in the second year, evenness raised the diversity of the fauna without *Mediomastus* (Figure 97). In August, 1971, a sharp decrease in evenness drove down diversity at station 9, and lower species richness depressed diversity in December, 1971. Increase in diversity without *Mediomastus* after the first eleven months at station 10 reflected the increase in species richness (Figure 98). Invasion of less-degraded #2 fuel oil into the substratum of station 10 in August, 1971, lowered evenness more than it raised species richness, and so lowered diversity of the fauna without *Mediomastus*. Species richness was as low in that month as in the first year. In the late winter of 1971-72, increased evenness raised diversity at station 9, whereas greater species richness elevated diversity at station 10.

At station 20, evenness generally predominated before July, 1970, and species richness afterward (Figures 99, 100). In August, 1970, species richness was low and evenness lower at both stations 20 and 35. At station 35, high richness (Figures 101, 102) usually prevailed over evenness, especially at first and after July, 1970. The preponderance of species richness was greatest in September, 1970. Station 35 was unusual in that high species richness,

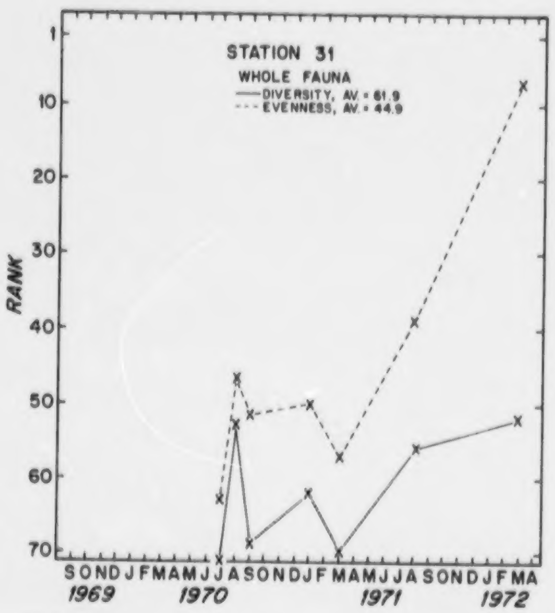

Figure 93. Relative ranks of diversity based on rarefaction and evenness of the whole fauna at station 31.

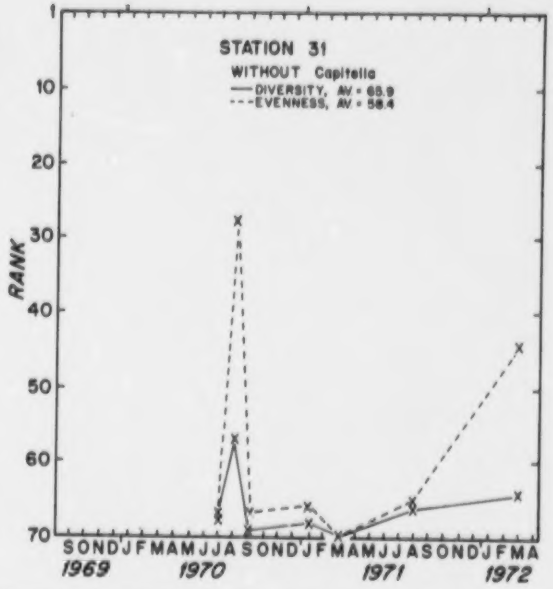

Figure 94. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Capitella* at station 31.

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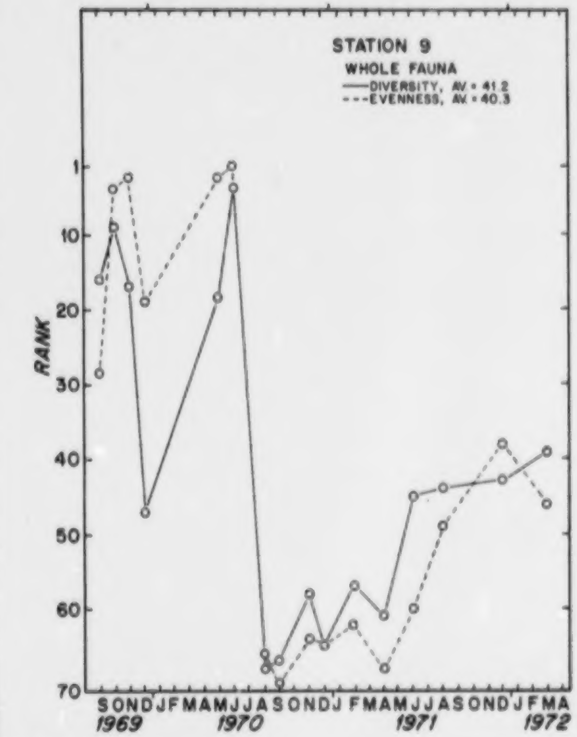

Figure 95. Relative ranks of diversity based on rarefaction and evenness of the whole fauna at station 9.

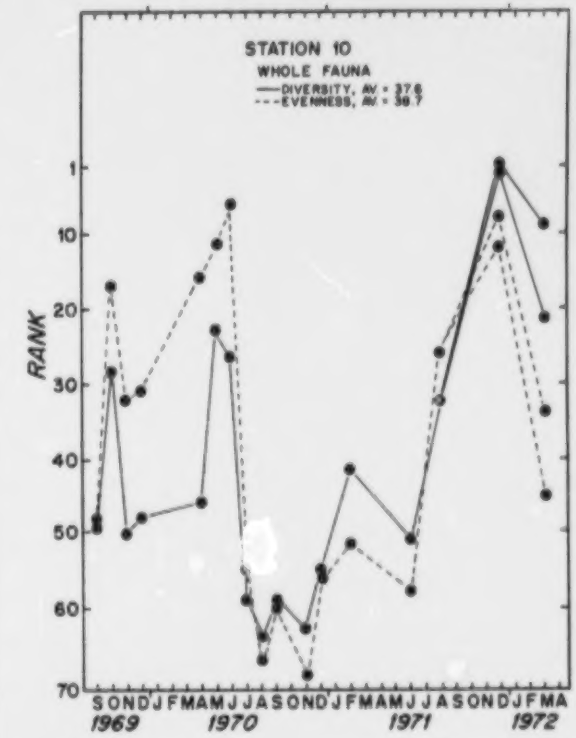

Figure 96. Relative ranks of diversity based on rarefaction and evenness of the whole fauna at station 10. Bifurcation of lines indicates replicate samples.

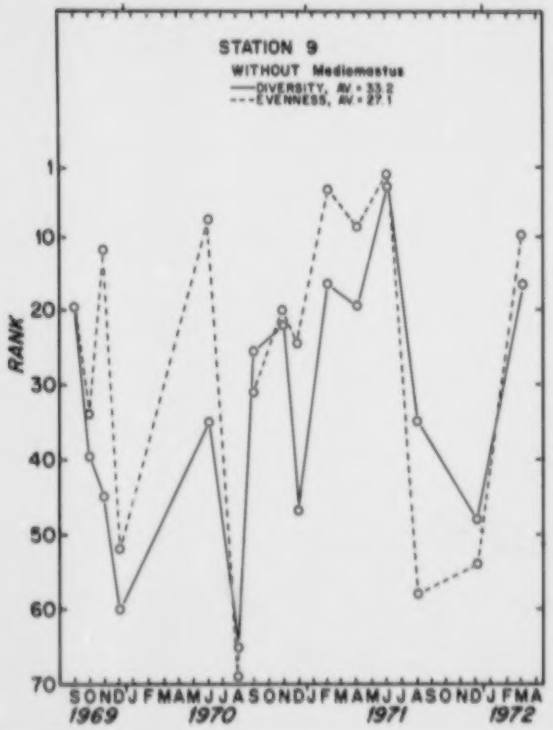

Figure 97. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Mediomastus* at station 9.

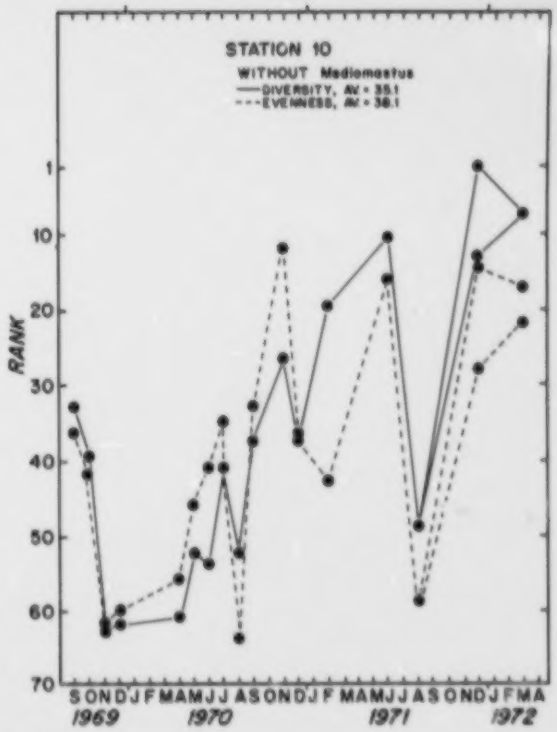

Figure 98. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Mediomastus* at station 10. Bifurcation of lines indicates replicate samples.

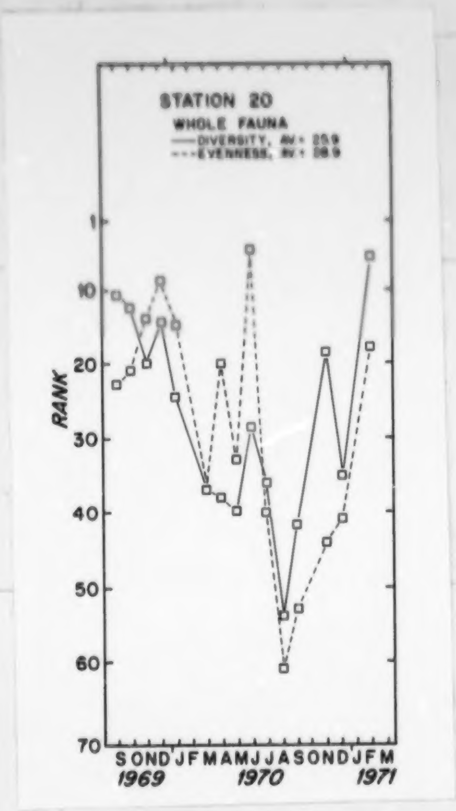

Figure 99. Relative ranks of diversity based on rarefaction and evenness of the whole fauna at station 20.

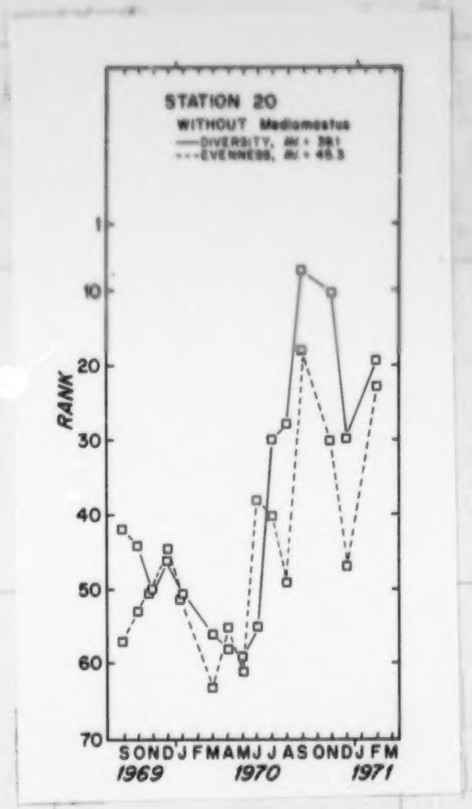

Figure 100. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Mediomastus* at station 20.

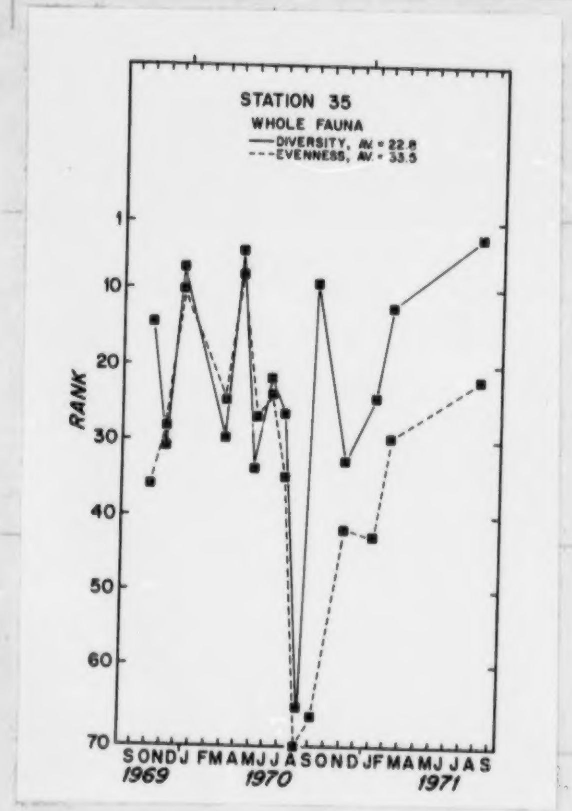

Figure 101. Relative ranks of diversity based on rarefaction and evenness of the whole fauna at station 35.

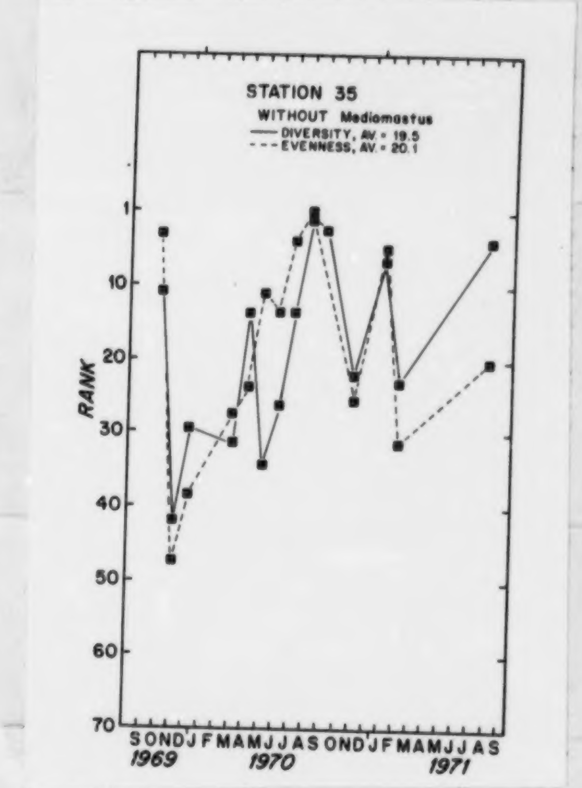

Figure 102. Relative ranks of diversity based on rarefaction and evenness of the fauna without *Mediomastus* at station 35.

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rather than evenness, generally contributed more to diversity in the first year. Without *Mediomastus*, evenness and species richness at station 35 were very high and almost equally influential in August, 1970. In the second year increased species richness raised diversity.

This analysis suggests that species richness is more important than evenness, the other component of diversity, in faunal recovery after pollution, and is a less variable, more conservative, and more reliable index of recovery.

Cluster Analysis

Samples of the whole fauna at farthest offshore, lightly oiled station 35 were fairly similar among themselves, and unlike samples from other stations. The amphipod fauna here remained normal. Samples cluster by month and season (Figure 103, cluster C; Figure 104, cluster D). Samples taken in the winter after the spatfall of August, 1970, however, cluster with those taken in the months just before the bloom of *Mediomastus*, rather than with other winter samples. Without *Mediomastus*, these winter samples cluster with other winter samples (Figure 105, cluster C; Figure 105, cluster D). Samples taken during the bloom of *Mediomastus*, in August and September, 1970, aggregate with samples from station 10 (Figure 103, cluster B; Figure 104, clusters B, C). Without *Mediomastus*, these samples cluster with those of the same or adjacent months of other years at station 35. In these summer months recruitment to the whole fauna is maximal. The fauna at this lightly oiled station underwent normal, modest seasonal changes, and, except for the brief bloom of *Mediomastus*, varied only slightly from year to year.

Offshore stations 5 and 20 were lightly oiled; effects were not patent until a month after the spill. The faunas of these two stations were essentially identical. When compared with those of stations 10 and 35, samples of the fauna with and without *Mediomastus* from station 20 cluster tightly together (Figure 103, cluster D; Figure 105, cluster D). The samples do not cluster in any obvious seasonal or successional pattern, except for those of the months of faunal recruitment, which tend to cluster. Without *Mediomastus*, groups of samples from the autumn and winter of successive years differ from each other. When samples from stations 20, 5, 9, and 30 are compared, those of stations 5 and 20 behave as replicates (Figure 107, cluster C; Figure 108, cluster C). The clustering of the whole fauna is not obviously by time or station; without *Mediomastus*, however, clusters tend to be tighter and seasonal.

Without *Mediomastus*, the two samples from station 5 with anomalous sediments aggregate with samples from station 9, to which they are similar in fauna and granulometry (Figure 107, clusters A, B; Figure 108, cluster A). The whole fauna at station 20 in August, 1970, was similar to summer samples of the same year from stations 9 and 30. Without *Mediomastus*, this August sample was similar to the others from station 20, although seasonal recruitment rendered this sample the least similar of the cluster (Figure 107, cluster B; Figure 108, cluster C). At stations 5 and 20 the fauna was fairly stable in the first ten months, before *Mediomastus* became common. The July, 1970, samples were quite distinct, and marked the transition from the cluster

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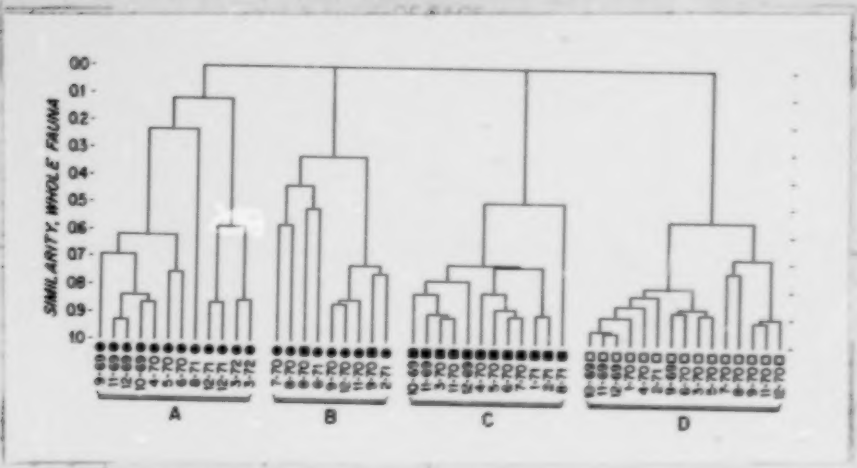

Figure 103. Samples of the whole fauna from stations 10, 35, and 20 clustered by normalized expected species shared.

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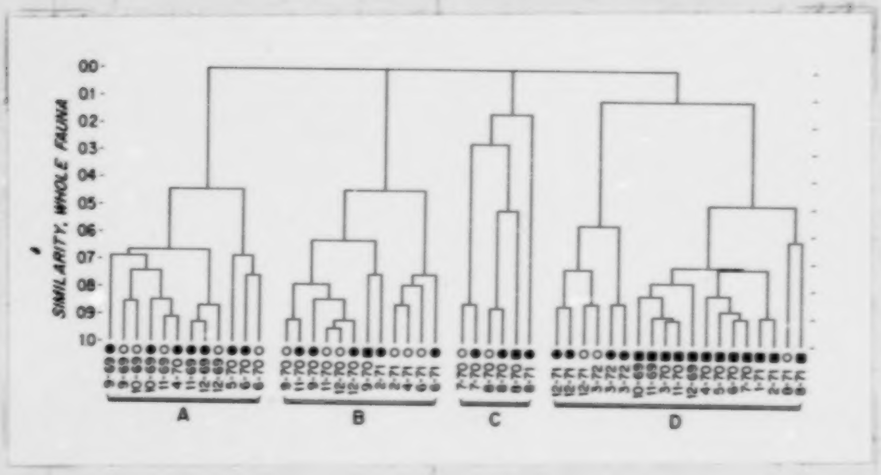

Figure 104. Samples of the whole fauna from stations 9, 10, and 35 clustered by normalized expected species shared.

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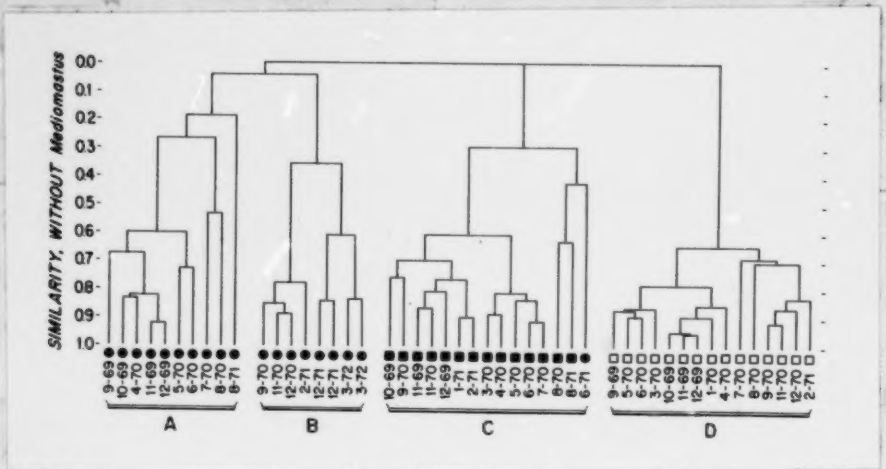

Figure 105. Samples of the fauna without *Mediomastus* of samples from stations 10, 35, and 20 clustered by normalized expected species shared.

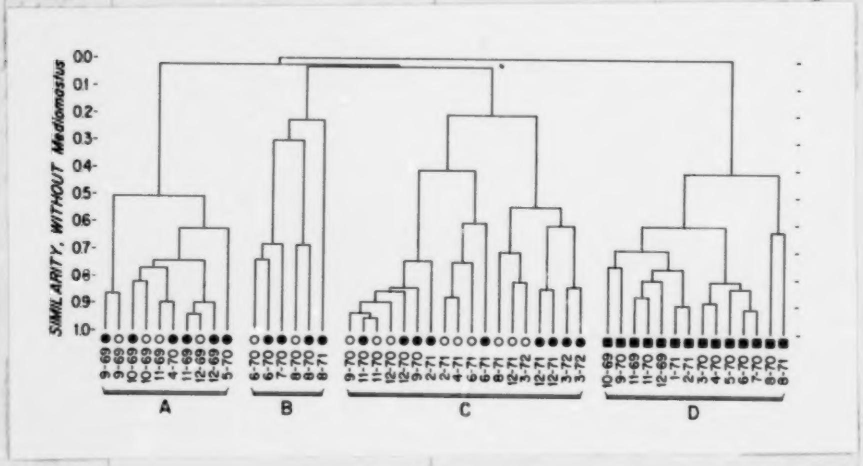

Figure 106. Samples of the fauna without *Mediomastus* from stations 9, 10, and 35 clustered by normalized expected species shared.

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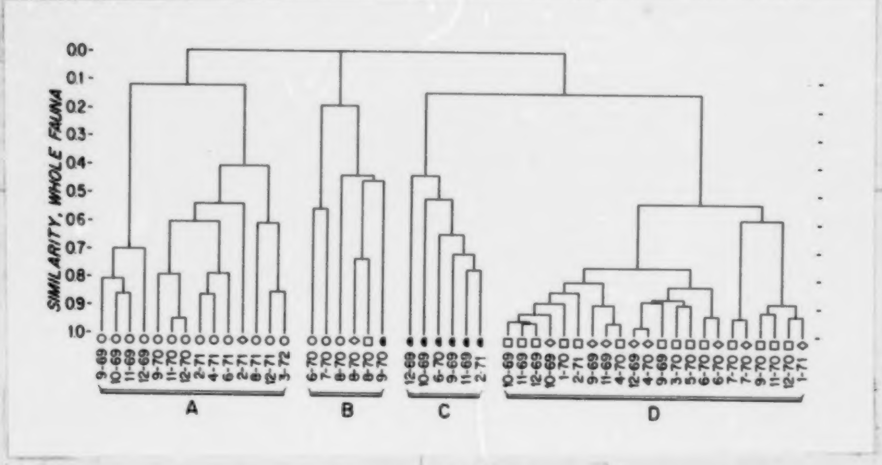

Figure 107. Samples of the whole fauna from stations 9, 30, 20, and 5 clustered by normalized expected species shared.

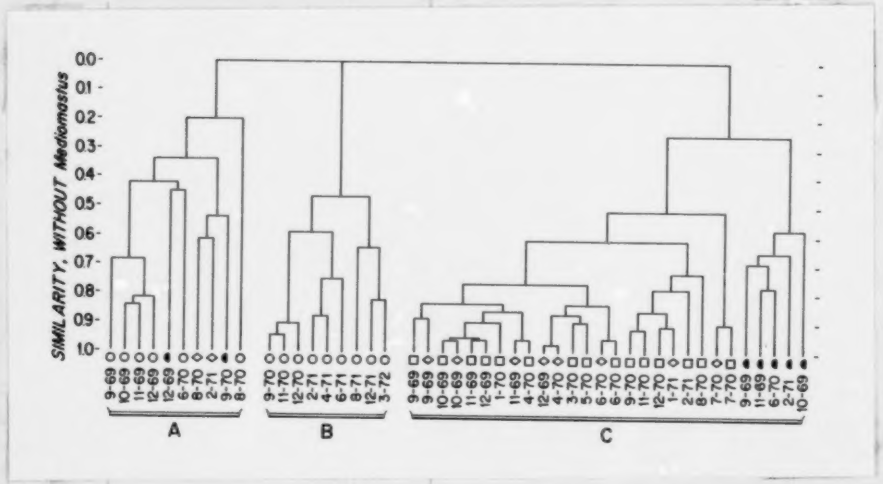

Figure 108. Samples of the fauna without *Mediomastus* from stations 9, 30, 20, and 5 clustered by normalized expected species shared.

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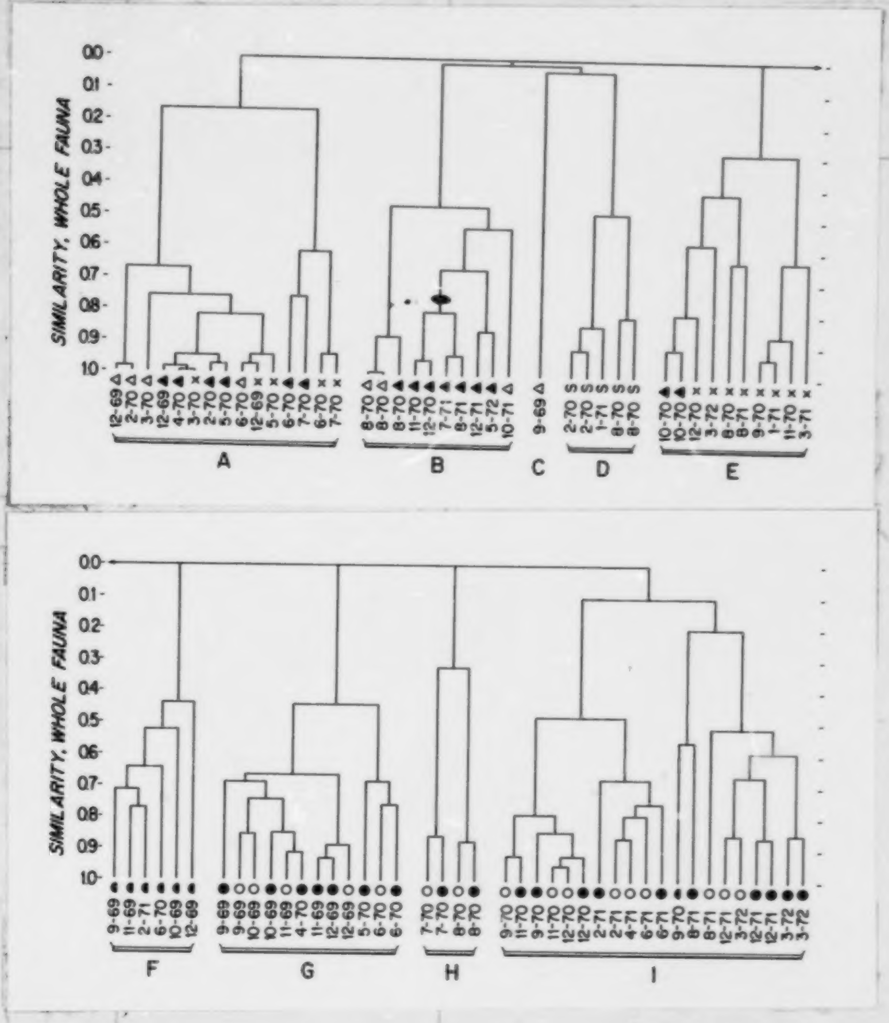

Figure 109. Samples of the whole fauna from stations II, IV, 31, 30, 9, and 10, and Sippewissett Marsh clustered by normalized expected species shared.

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of the initial period to the cluster of the following autumn and winter.

When compared with those of stations 20 and 35, samples from intermediately oiled station 10 form two annual clusters (Figure 103, clusters A, B). Without *Mediomastus*, samples from this station cluster slightly closer (Figure 105, cluster A, B). Replicate samples cluster together, with and without *Mediomastus*. The whole fauna of the third year, when diversity was high, was somewhat similar to that of the first year; without *Mediomastus*, the samples of the third year cluster with those of the second. The sample taken in August, 1971, when less-degraded #2 fuel oil reinvaded this station and disrupted the fauna, clusters with those of the first seven post-spill months. Samples of the whole fauna of the second year were all dominated by *Mediomastus*.

When compared with those of stations 5, 20, and 30, samples from intermediately oiled station 9 aggregate rather loosely and temporally in annual clusters (Figure 107, clusters A, B; Figure 108, clusters A, B). The fauna was scanty in the first ten months after the spill. The abundance of various species, including *Mediomastus ambiseta*, caused the samples from the summer of 1970 to cluster, not with other samples from this station, but with summer samples from other stations. Without *Mediomastus*, the temporal sequence is clearer.

Despite some differences in sediments, faunal samples from stations 9 and 10 cluster together as replicates and in temporal array (Figure 104, clusters A-D; Figure 108, clusters G-I). Samples richest in *Mediomastus* cluster, regardless of year. Throughout the three years after the spill, faunal changes at these two stations were large, rapid, synchronous, and successional. When station 10 was re-oiled in August, 1971, the fauna reverted to the condition prevalent in the first seven months following the spill.

Concentrations of oil at station 30 were intermediate, similar to those at stations 9 and 10. The general character of the fauna at station 30 was strongly influenced by grain size; most samples from this nearshore station cluster loosely with those of stations 5 and 20 (Figure 107, cluster G; Figure 108, cluster C). Without *Mediomastus*, they cluster more closely with these granulometrically similar stations. The fauna was scanty for ten months after the spill, and underwent large, rapid successional changes. The sample of September, 1970, clusters with samples from the season of recruitment at stations 5 and 20, and with a sample from station 10 taken after the reinvasion of fuel oil (Figure 109, cluster I).

The difference in water depth and granulometry between subtidal station 31 and intertidal stations II and IV ordinarily would be attended by differences in fauna. The features characteristic of these three stations were the high concentrations of #2 fuel oil, and the opportunistic fauna dominated by *Capitella* spp., *Polydora ligni*, and *Microphthalmus aberrans* during the first year (Grassle & Grassle, 1971, 1976, 1977). Samples from these three stations are scattered among several clusters. Almost all samples taken in the first eleven months, when the fauna was very sparse, cluster by date, although the samples of June and July, 1970, cluster by station (Figure 109, cluster A).

Many samples of the second year cluster together, and tend to cluster by station (Figure 109, clusters B, E). Replicate samples taken at station IV resemble each other (Figure 109, cluster E). Samples of the season of recruitment, some of those of the second year, and those of the third year resemble one another (Figure 108, cluster B). Within this cluster the samples aggregate by station. The sample taken at station II on September 19, 1969, before the populations of *Gemma gemma* had been killed, is not like the other samples taken at any of these three stations, but is somewhat similar to samples from unpolluted Sippewissett Marsh (Figure 109, clusters C, D). After the heavy settlement of juveniles in the summer of 1970, the fauna underwent successional changes, and by the end of the second year and beginning of the third year after the spill it had not yet attained the level of stability prevalent at lightly oiled station 35. The fauna at these severely oiled stations had not recovered.

Samples from the unoiled control station in Sippewissett Marsh cluster tightly together, and show little resemblance to samples from Wild Harbor River (Figure 108, cluster D). Replicate samples cluster together, and, as usual, samples taken in the summer are not closely similar to those taken in other seasons. Faunal changes were modest and seasonal.

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SECTION 5

DISCUSSION

Oil Pollution

Analyses of hydrocarbons in the sediments showed that #2 fuel oil spilled by the FLORIDA invaded Wild Harbor River and nearby offshore areas, and established a gradient in severity of pollution from most severe in the river to least severe at the most distant offshore stations. Severity of pollution was manifest in the original concentrations of oil and in the rates of degradation of the various components of the oil. Almost every sample contained hydrocarbons identified by the ratio of adjacent homologues as the #2 fuel oil spilled by the FLORIDA. Concentrations of hydrocarbons were high for at least five years in the peat and mud of the intertidal and subtidal zones of Wild Harbor River, less at nearshore stations, and least and ephemeral at the more distant offshore stations. After the spill, oil spread seaward in pulses from the heavily oiled inshore areas; one of these waves reached station 10 in August, 1971.

Biodegradation and dissolution were the chief modes of degradation of the oil. Bacterial action was delayed for several months at the most heavily oiled station. Biodegradation began sooner at intermediately oiled stations. The fact that readily degraded *n*-alkanes persisted at all stations for at least two years suggests that bacterial seeding may not be effective in reducing oil residues in polluted sediments. Constituents of low boiling point attenuated slowly at the heavily oiled sites and were still detectable after two years at intermediately and lightly oiled stations.

Mortality

Mass mortality of many kinds of animals supervened within hours after the spill. The extent and rate of mortality was highest at the most severely oiled stations, and least at the lightly oiled stations.

Amphipod crustaceans of the family Ampeliscidae are very common members of the shallow water infauna of New England (Mills, 1963, 1964, 1965, 1967a, b; Sanders, 1956, 1958). *Ampelisca vadorum, A. abdita, A. verrilli,* and *Byblis serrata* were found alive in the sandy substratum of Buzzards Bay. Recruits ordinarily swim into an area from elsewhere and, in favorable conditions, build tubes in the sediment and persist. In the presence of pollutant fuel oil, however, these amphipods die. After the ESSO ESSEN spill of crude oil in South Africa in 1968, amphipods in the intertidal and subtidal zones suffered severe mortality, whereas other members of the megafauna survived (Stander and Venter, 1968). Oil spilled by the AMOCO CADIZ off Brittany

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in 1978 penetrated the bottom sediments and killed immense numbers of the trophically important ampeliscid amphipods (Cabioch, Dauvin, and Gentil, 1978). In West Falmouth, amphipod mortality was greatest and of longest duration at the most heavily oiled stations, and successively less severe and of shorter duration at less heavily oiled stations.

The Falmouth shellfish warden reported the mortality in 1970 of 769 bushels of soft-shelled clams, 1135 bushels of native seed clams, and all seed and parent stocks of clams transplanted in that year in Wild Harbor River (Souza, 1970). He set the value of these animals at $27,573. A few of the shellfishing areas closed after the FLORIDA spill were opened in 1973, but the catch was below former levels (Souza, 1973).

Analysis of variance and covariance of faunal densities at stations 9, 10, 20, and 35 showed that in the ten months following the first season of recruitment after the spill the decline of the fauna without the extremely abundant *Mediomastus ambiseta* was moderate at the intermediately oiled stations 9 and 10, slight at lightly oiled station 20. At station 35, also lightly oiled, faunal density increased. Mortality of *Mediomastus* was very high at station 10 in this same period, and less but still great at the other three stations.

The high mortality in Wild Harbor River in all probability had adverse effects on the habitability of the substratum. Infauna, especially deposit feeders, and prowling predators modify the substratum by plowing, burrowing, feeding, excreting, and binding grains together (Rhoads, 1963, 1967). Their activities loosen the sediment, allowing penetration of oxygenated water to depths of six centimeters (Rhoads and Young, 1970). The mass mortality of the benthic biota brought bioturbation and oxygenation to an end. For several weeks after the spill, the sediments at stations 31 and 30 were black and anoxic. At station 31 hydrogen sulfide was obviously present. Decay of tissue was arrested for lack of organisms which break down organic matter, and dead animals were numerous. Throughout the study, anaerobic conditions prevailed at station 31, while the sand at offshore station 35 was light in color, apparently well oxygenated.

Faunal Stability

When the physical and biological parameters vary slightly and predictably from year to year, the fauna is diverse and relatively stable in numbers and composition. Whenever some environmental parameter, or exotic influence, exceeds the normal range of variation or rate of change, the fauna suffers dislocation or stress or severe mortality. As a result of this stress, the fauna is less diverse and undergoes successional changes. In the first stage of succession, opportunists dominate the fauna, and density is quite variable. As succession progresses, density and faunal composition become more stable. During succession there may be an ephemeral phase of high diversity when the environment is still undersaturated (the non-interactive phase of Simberloff and Wilson, 1969). This short-lived diversity is not the diversity that develops on an evolutionary time scale. In a stable shallow water environment, a characteristic community becomes established (Grassle and Sanders, 1973). Such is the *Nephtys-Nucula* community in the muds of

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south-central Buzzards Bay, which has changed little in almost two decades. Pearson and Rosenburg (1978) have reviewed the manifold changes of faunas in response to abruptly changed levels of organic matter, including petroleum.

Faunal changes which resulted from the FLORIDA oil spill are considered under three headings: first, changes in density, number of species, diversity, and evenness; second, changes in faunal composition; and third, the seasonal or successional character of these compositional changes. The analyses concur in showing that faunal changes were most severe in degree and character at the most heavily oiled stations, and least severe at the lightly oiled stations.

At stations II, IV, and 31, density and numbers of species showed broad and rapid changes. Average density of the fauna without *Capitella* was lowest and most variable at these stations throughout the three-year sampling period. This variability decreased with the passage of time. Opportunistic *Capitella* increased explosively to occupy the denuded substratum in vast numbers, then within a few months crashed. By the end of the sampling period, densities and numbers of species had not risen to the initial levels. The fauna at station 31 underwent sharp, frequent fluctuations in diversity for at least three years. The very low diversity at this station was due to the small number of species and low evenness.

At intermediately oiled nearshore subtidal stations 9 and 10, nearly synchronous fluctuations in density and number of species were rapid and initially almost as broad as those at the more heavily oiled stations. Fluctuations began to lessen in amplitude during the second year, but still had not stabilized by the end of two and one-half years. At these stations *Mediomastus ambiseta* monopolized the bottom in the second year, and declined in later years. Reinvasion of station 10 by fuel oil in August, 1971, prevented the surge of numbers that can occur on biologically unsaturated substrata during the season of recruitment. Density of the fauna without *Mediomastus* at these stations was low and only slightly variable in the first eleven months, more variable in the second year, and higher and less variable thereafter. At these two nearshore stations changes in diversity were also nearly synchronous. During the first ten months after the spill, density was so low that diversity and evenness were deceptively high. In the second year diversity and evenness were low. After early to mid-summer of 1971 diversity and evenness were high. Diversity and evenness of the fauna without *Mediomastus* were low in the first year and less variable than those of the whole fauna. After the first year, species richness raised diversity at stations 9 and 10, but recovery of evenness and diversity was slow at these two stations, slower at station 9.

At lightly oiled stations 20 and 35 variability in density and numbers of species was relatively slight, with and without *Mediomastus*. After a brief surge of *Mediomastus* in August, 1970, density and numbers of species increased, and soon stabilized. At station 35 diversity and evenness were generally high and fairly uniform. Values decreased in the summer of 1970, when *Mediomastus* was dominant, but increased soon thereafter, and became stable. At station 20 diversity and evenness of the fauna with and without *Mediomastus* were usually fairly high and uniform. The whole fauna here was

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slightly more diverse than that at station 35, but the fauna without *Mediomastus* at station 20 was usually less diverse. Diversity and evenness decreased during the season of recruitment of 1970. At station 20 *Mediomastus* declined soon after August, 1970, and diversity and evenness recovered. Species richness raised diversity after the first year at stations 20 and 35.

At many stations, density, number of species, diversity, and evenness declined slightly in the winter or early spring. This decline was perhaps due to the death of short-lived animals during the colder months. During the breeding season, the few remaining animals propagated, and contributed to the rise in density and diversity during the spring and summer.

Michael, Van Raalte, and Brown (1975) extended analysis of the benthic fauna at stations II, IV, V, 31, 9, 10, 20, and 35 into the fourth and fifth years after the spill. Species were fewer and more opportunistic at the intertidal stations in Wild Harbor River than in Sippewissett Marsh. The fact that densities remained very low in Wild Harbor River indicates considerable inhibition of secondary production there. At station 31 species were usually few, turnover of faunal composition was rapid, and most individuals were juveniles which died before attaining maturity. Although the average number of species increased somewhat in 1974 at stations 9 and 10, species at these two intermediately oiled stations were fewer and more opportunistic than those at minimally oiled stations 20 and 35.

Indices of discrepancy and constancy show that changes in faunal composition were greater at the heavily oiled stations and least at the lightly oiled stations. The number of species of constancy greater than 0.45 was least at stations in Wild Harbor River, somewhat greater at the nearshore subtidal stations, and greatest at the more distant subtidal stations. Faunal turnover was greatest at stations II, IV, and 31, least at stations 5, 20, and 35. The fauna at station 31 was still unstable in composition after three years. At stations 9 and 10 faunal composition was still unstable, but showed slight recovery after two years. At lightly oiled stations 20 and 35 faunal composition was fairly stable and recovered rapidly.

Analysis by discrepancy index also suggests that species near the limit of their ranges were most heavily affected and showed the poorest recovery. Thirty-two species principally affected the values of the index at station 10. Some species had the highest mean density in the first year. *Tubulanus pellucidus*, *Nephtys incisa*, and *Syllides verrilli* varied little in density, even in August, 1970. *Rochefortia cuneata*, *Mulinia lateralis*, *Tagelus divisus*, *Macoma tenta*, and *Cylichna oryza*, all mollusks, were abundant only in August, 1970. *Mulinia lateralis* and *Cylichna oryza* occur northward to Maine, but the others extend only as far north as Cape Cod. *Pectinaria gouldii* was common in both July and August of 1970. Cape Cod seems to be the northern limit of this species. Other species were densest in the second year. *Mediomastus ambiseta*, *Acteocina canaliculata*, and *Chaetozone* sp. were abundant in August, 1970, as well as in the second year. *Glycinde solitaria*, *Podarke obscura*, *Glycera americana*, *Mitrella lunata*, and *Odostomia winkleyi* were densest in the autumn of 1970, although a few animals of these species had settled as early as August, 1970. All five of these

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species have their northern limits in southern Massachusetts. *Odostomia sumneri*, known to occur only in the Woods Hole area, was most abundant in the autumn and early winter of 1970-71. *Capitella* spp. were densest in August, 1971, when less-degraded #2 fuel oil re-invaded station 10, *Sphaerosyllis hystrix* was nearly equally dense in the second and third years, and much more abundant than in the first year. Yet other species were densest in the third year. *Minuspio cirrifera, Protodorvillea gaspeensis, Phascolion strombi, Ampelisca abdita,* and Nemertine B all increased gradually in density in the three years. Most of these species also occur as far north as the Gulf of Maine or the Canadian Arctic Archipelago. *Eumida sanguinea* and *Sphaerosyllis erinaceus* were uncommon in the first year, abundant in the second year and slightly more abundant in the third year. These species extend from Iceland to the Caribbean Sea, and from the Arctic Ocean to Virginia. *Corophium tuberculatum, Yoldia limatula,* and *Asychis elongata* were much more abundant in the third year than in the earlier two years. The first two species extend to the north of Cape Cod, but the other species does not. Many species in the North Atlantic, especially those of the Virginian Marine Province, require high summer temperatures for survival of larvae, but can withstand the commonly very low winter temperatures in the intertidal and shallow subtidal zones. In general, it appears that those species whose northern limit is southern New England were least stable, but those which extend farther northward showed better recovery. Boesch, Wass, and Virnstein (1976) noted that species which were not opportunistic and were near the limits of their ranges declined in abundance after the fauna was disturbed by a tropical storm.

Cluster analysis of the fauna with and without the dominant polychaete and graphic analysis of subdominants showed that changes in faunal composition were successional at the heavily oiled stations. At intermediately oiled stations faunal changes were predominantly successional, but at lightly oiled stations these changes were seasonal. Changes in faunal composition were independent of the character of the substratum.

The initial samples from stations II, IV and 31 clustered together in temporal sequence despite differences in sediments; samples taken after the first year showed a slight tendency to cluster by station. One suite of subdominants replaced another every six to ten months; none of the suites recurred once it disappeared. Although many subdominants were common to these three stations, their proportions varied from station to station. Most species tended to be subdominant in the same sequence at these stations, but *Streblospio benedicti* and *Nereis succinea*, which occurred together at stations II and IV in late 1970 and early 1971, tended to occur separately at station 31 until early 1973.

Samples from intermediately oiled stations 30, 9, and 10 clustered by temporal sequence for many months after the spill. Samples taken more than one and one-half years tended to cluster by season. The sequence of subdominants at station 9 was similar to that at station 10. Only *Sphaerosyllis hystrix* seasonally recurred. Few species at stations 9 and 10 were in common with stations 31, II, or IV, or with stations 5, 20, or 35.

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Samples from lightly oiled stations 5, 20, and 35, and from the control station in Sippewissett Marsh clustered by station and season. Only those samples from station 5 with anomalously fine sediments clustered with samples from stations more heavily oiled. Stations 5, 20, and 35 shared most members of a small suite of subdominants, which recurred seasonally. Particularly evident was the alternation of *Sphaerosyllis hystrix* with *Exogone verugera*, and of *Ampelisca abdita* with *A. vadorum*. In unoiled Sippewissett Marsh, the suite of abundant varied little from one sample to another.

Comparison of results obtained by Sumner, Osburn, and Cole (1913), Hough (1940), and Moore (1963) shows that the boundaries between coarser sands, finer sands, and mud remained stable for about fifty years. Analyses of sediments collected in this study showed only slight temporal trends in median grain size and sorting. The effects of sedimentary texture on faunal composition is suggested by the abundance of *Odostomia winkleyi* and *Chaetozone* sp. in the fine sediments of station 9 and in the similarly fine sands at station 5 in February, 1971. At station IV the increase in the amount of mud may have resulted from an early removal of fines by waves impinging on the bottom, or from the later influx of fine sediment from the marsh. The general trend toward finer grain size may also reflect the recolonization of the bottom, after about sixteen months, by organisms capable of binding mud. A cluster analysis performed on some of the granulometric data showed that samples clustered first by median grain size, then by sorting or skewness; and that there were not any clearly defined temporal trends in these characters. The successional and seasonal changes in the fauna were not, therefore, related to the granulometry of the sediments.

Physiological and Behavioral Disturbances

The fact that diversity and density may have increased and stabilized does not mean that damage was at an end. Further studies of the fauna in the area affected by the FLORIDA spill have shown that oil pollution forces animals to turn from the most economical biochemical pathways to others physiologically more costly, and that fuel oil distorts behavioral responses to inadaptive or even lethal modes.

Krebs and Burns (1977) measured the effect of the FLORIDA spill on populations of the fiddler crab, *Uca pugnax*, in Wild Harbor Marsh over a span of seven years. They found that lightly weathered #2 fuel oil with more than 20% aromatics and in concentrations greater than 1000 ppm at the sediment-water interface, killed adult crabs. Residues of the same oil in concentrations of 100 to 200 ppm killed overwintering juveniles, and were cumulatively sublethal at lower concentrations. With increasing concentrations of oil residues the crabs suffered impaired activity, loss of equilibrium,and death. The higher the concentration, the shorter the life of the crab. Concentrations which were sublethal for the moment, immobilized and killed if persistent. According to survival rates for the first two year-classes after the spill, densities of *Uca* were lower at all stations at which sediments contained more than 200 ppm of petroleum hydrocarbons. The higher the concentration of oil,the lower the density of crabs. Density remained low in Wild Harbor Marsh for at least seven years before recovery began. Immediately after the spill, many surviving adult crabs molted and showed breeding coloration out of season. Because of their loss of equilibrium and impaired escape response, the crabs were very vulnerable. This locomotory impairment, which was manifest at least four years after the spill, was most evident at temperatures near the lower limit of the crab's range of activity, 13°C, in May and September, when coming out of or going into winter dormancy. Crabs in moderately and heavily oiled sediments dug burrows too shallow to protect them from freezing in winter. The death of juveniles, and the locomotory and behavioral impairment and ensuing death of adults indicate that oil caused the reduction of fiddler crab populations in Wild Harbor Marsh for at least seven years after the spill.

Chronically exposed *Fundulus heteroclitus*, a small estuarine fish, from Wild Harbor Marsh contained in its tissues as much as 75 ppm petroleum hydrocarbons from the 1969 FLORIDA oil (Burns, 1976). The fish from the control area in unpolluted Sippewissett Marsh did not have residues of #2 fuel oil in their tissues.

Biochemical differences between *Fundulus* populations from the two marshes were obvious. Tissues of the fish from contaminated Wild Harbor showed a lower net rate of hepatic lipogenesis than did those fish in uncontaminated Sippewissett Marsh. Incorporation of acetate-1-^{14}C in the gill, muscle, and brain tissues was 40-50% lower in the Wild Harbor *Fundulus* than in fish from Sippewissett Marsh. The pronounced decrease in the rate of hepatic phospholipid synthesis suggests that the oil affected the cell membranes on the cytoplasmic or intracellular surface, for phospholipids and cholesterol are the major constituents of most membranes (Sabo and Stegeman, 1977). The rate of synthesis of triglyceride was also much lower. Serum of oil-contaminated Wild Harbor *Fundulus* contained less nitrogen as urea, glucose, triglycerides, and cholesterol than did serum of the Sippewissett controls. Oil-induced physiological stress draws heavily on several stores of energy (Sabo, Heineke, and Stegeman, 1977).

Studies on polluted animals from other areas show that physiological stress is also manifested in higher energy demand. *Mya arenaria* and two species of mussels living in sediments contaminated with petroleum hydrocarbons showed changed carbon flux (Gilfillan, 1975; Gilfillan, *et al.*,1976). The higher the concentrations of petroleum hydrocarbons, particularly of aromatics, the higher the metabolic demand, the lower the rate of assimilation, the slower the growth, and the lower the fertility. It is clear that increasing environmental stress so elevates metabolism and reduces assimilation as to leave too little energy for growth and reproduction. As a result, most species disappear from such an environment, leaving only those few tolerant species typical of chronically polluted habitats.

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APPENDIX A

STATION-II POLYCHAETES SAMPLE SIZE $^1/_{128}$ M^2

SPECIES	IX-19-69	IX-26-69	XII-7-69	II-24-70	III-31-70	VI-16-70	VIII-3-70	VIII-3-70	X-1-70	I-11-71	III-1-71	X-6-71									
Harmothoe extenuata																					
Lepidonotus squamatus																					
Pholoe minuta																					
Sigalion arenicola																					
Sthenelais boa																					
Eteone longa					1				3	2	4										
Eumida sanguinea																					
Paranaitis speciosa																					
Phyllodoce arenae																					
Phyllodoce maculata																					
Gyptis vittata																					
Microphthalmus aberrans	4	8	2		7	9	4	1													
Microphthalmus sczelkowii																					
Podarke obscura																					
Ancistrosyllis groenlandica																					
Ancistrosyllis hartmanae																					
Cabira incerta																					
Autolytus fasciatus																					
Brania clavata																					
Brania wellfleetensis																					
Exogone dispar																					
Exogone verugera									1												
Odontosyllis fulgarens																					
Parapionosyllis longicirrata	4																				
Sphaerosyllis erinaceus																					
Sphaerosyllis hystrix	2	1																			
Syllides verrilli	1						8	18	1	1	2	4									
Syllis gracilis																					
Nereis arenaceodonta																					
Nereis grayi																					
Nereis larvae										1											
Nereis succinea			3	1	1				12		16	6									
Nereis virens																					
Platynereis dumerilii																					
Micronephthys minuta																					
Nephtys incisa																					
Nephtys picta																					
Ephesiella minuta																					
Glycera americana																					
Glycinde solitaria									1												
Diopatra cuprea																					
Onuphis conchylega																					
Onuphis quadricuspis																					
Marphysa sanguinea																					
Lumbrinereis coccinea																					
Lumbrinereis fragilis																					
Lumbrinereis tenuis																					
Ninoe nigripes																					
Arabella iricolor																					
Protodorvillea gaspeensis																					
Stauronereis caeca																					
Stauronereis ruldolphi																					
Scoloplos acutus	5																				
Scoloplos fragilis																					
Scoloplos robustus																					

STATION—II (cont.) **POLYCHAETES**

SPECIES	IX-19-69	IX-26-69	XII-7-69	II-24-70	III-31-70	VI-16-70	VIII-3-70	VIII-3-70	X-1-70	I-11-70	III-1-71	X-6-71									
Aedicira belgicae																					
Aricidea jeffreysii					1			1													
Aricidea quadrilobata																					
Aricidea suecica																					
Cirrophorus lyriformis																					
Paraonis fulgens																					
Paraonis gracilis																					
Paraonis lyra																					
Dispio uncinata																					
Polydora caulleryi																					
Polydora ligni						21	20	23	5			3									
Polydora websteri																					
Prionospio cirrifera																					
Prionospio heterobranchia							1	2													
Pygospio elegans																					
Scolelepis texana																					
Spio filicornis					1																
Spionid larvae					1					6	1										
Spiophanes bombyx																					
Spiophanes wigleyi																					
Streblospio benedicti								1	12	4	7	55									
Magelona sp.																					
Spiochaetopterus oculatus																					
Caulleriella sp.																					
Chaetozone sp.																					
Flabelligera affinis																					
Pherusa affinis																					
Scalibregma inflatum																					
Capitella capitata		5	1219	327	488	2104	109	86	30	1		15									
Heteromastus filiformis																					
Mediomastus ambiseta																					
Notomastus latericeus																					
Notomastus luridus																					
Maldanopsis elongata																					
Praxillella praetermissa																					
Sabellaria vulgaris																					
Pectinaria gouldii																					
Amage auricula												5									
Ampharete acutifrons																					
Ampharete arctica																					
Amphicteis gunneri																					
Asabellides oculata																					
Melinna cristata																					
Pista cristata																					
Pista palmata																					
Polycirrus eximius																					
Fabricia sabella						1				1		1									
Potamilla neglecta																					
Sabella microphthalma																					
Filigrana implexa																					
Hydroides dianthus																					
Spirorbis borealis																					
Spirorbis granulatus																					
Spirorbis violaceus																					
TOTAL INDIVIDUALS	16	14	1224	328	500	2135	142	132	65	16	30	89									
TOTAL SPECIES	5	3	3	2	6	4	5	7	8	6	5	7									

STATION—IV POLYCHAETES SAMPLE SIZE $\frac{1}{128}$ M^2

SPECIES	IX-21-69	X-9-69	XII-7-69	II-22-70	IV-19-70	V-20-70	VI-15-70	VII-14-70	VIII-6-70	X-2-70	X-2-70	XI-11-70	XII-8-70	III-1-71	IV-26-71	VI-4-71	VII-8-71	VIII-9-71	XII-17-71	IV-13-72	V-26-72
Harmothoe extenuata																					
Lepidonotus squamatus																					
Pholoe minuta																					
Sigalion arenicola																					
Sthenelais boa																					
Eteone longa		0.1				1							3	3	1	2	1		1		2
Eumida sanguinea										2									2		
Paranaitis speciosa								1													
Phyllodoce arenae																			1		
Phyllodoce maculata																					
Gyptis vittata																					
Microphthalmus aberrans		0.5		4		3	22	8	4					1					1		6
Microphthalmus sczelkowii																					
Podarke obscura																					
Ancistrosyllis groenlandica																					
Ancistrosyllis hartmanae																					
Cabira incerta																					
Autolytus fasciatus																					
Brania clavata																					
Brania wellfleetensis		0.1																			
Exogone dispar																					
Exogone verugera																					
Odontosyllis fulgarens																					
Parapionosyllis longicirrata		0.1																			
Sphaerosyllis erinaceus																					
Sphaerosyllis hystrix																					
Syllides verrilli	1	0.8						13	37	10	7	32	1	9	7	3	1	5	49	1	18
Syllis gracilis																					
Nereis arenaceodonta																					
Nereis grayi		0.7																			
Nereis larvae																					
Nereis succinea			1	2	3		1	1	1	21	5 7	10	8	7	4	8	6	2	8	7	56
Nereis virens																					
Platynereis dumerilii																1					
Micronephthys minuta																					
Nephtys incisa																					
Nephtys picta																					
Ephesiella minuta																					
Glycera americana																					
Glycinde solitaria										1		2					1	1	2		2
Diopatra cuprea																					
Onuphis conchylega																					
Onuphis quadricuspis																					
Marphysa sanguinea																					
Lumbrinereis coccinea																					
Lumbrinereis fragilis																					
Lumbrinereis tenuis																					
Ninoe nigripes																					
Arabella iricolor																					
Protodorvillea gaspeensis																					
Stauronereis caeca																					
Stauronereis ruldolphi																					
Scoloplos acutus						1								1							
Scoloplos fragilis		0.2																			
Scoloplos robustus																					

STATION–IV (cont.) **POLYCHAETES**

SPECIES	IX-21-69	X-9-69*	XII-7-69	II-22-70	IV-19-70	V-20-70	VI-15-70	VII-14-70	VIII-6-70	IX-2-70	X-2-70	XI-11-70	XII-8-70	III-1-71	IV-26-71	VI-4-71	VII-6-71	VIII-9-71	XII-17-71	III-13-72	V-26-72
Aedicira belgicae																					
Aricidea jeffreysii																					
Aricidea quadrilobata																					
Aricidea suecica																					
Cirrophorus lyriformis																					
Paraonis fulgens																					
Paraonis gracilis																					
Paraonis lyra																					
Dispio uncinata																					
Polydora caulleryi																					
Polydora ligni		1.9	1		1		8	18	10	2	3	2	6			37	15	9	18	11	61
Polydora websteri																					
Prionospio cirrifera																					
Prionospio heterobranchia											1										
Pygospio elegans																					
Scolelepis texana																					
Spio filicornis															1		2	8	21	25	42
Spionid larvae			1			1			1	1				5							
Spiophanes bombyx																					
Spiophanes wigleyi																					
Streblospio benedicti									5	66	36	30	31	14	20	5	23	12	12	19	
Magelona sp.																					
Spiochaetopterus oculatus																					
Caulleriella sp.																					
Chaetozone sp.								1													
Flabelligera affinis																					
Pherusa affinis																					
Scalibregma inflatum																					
Capitella capitata	19	42.0	1,641	586	631	979	1,782	241	72	7	11	12	34	14	7	6	23	39	115	1	111
Heteromastus filiformis																					
Mediomastus ambiseta						5	4									4	4				
Notomastus latericeus																					
Notomastus luridus																					
Maldanopsis elongata																					
Praxillella praetermissa																					
Sabellaria vulgaris																					
Pectinaria gouldii																					
Amage auricula																					
Ampharete acutifrons																					
Ampharete arctica																					
Amphicteis gunneri																					
Asabellides oculata																					
Melinna cristata																					
Pista cristata																					
Pista palmata																					
Polycirrus eximius																					
Fabricia sabella																					
Potamilla neglecta																					
Sabella microphthalma																					
Filigrana implexa																					
Hydroides dianthus																					
Spirorbis borealis																					
Spirorbis granulatus																					
Spirorbis violaceus																					
TOTAL INDIVIDUALS	20	46.4	1644	592	635	990	1817	283	130	110	70	66	63	54	40	66	76	76	230	64	298
TOTAL SPECIES	2	9	3	3	3	6	5	7	6	7	6	6	6	7	6	8	9	7	11	6	8

*ADJUSTED FROM 12" SQUARE, PUT THROUGH 0.297 mm SCREEN

STATION—5 POLYCHAETES SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-27-69	X-22-69	XI-19-69	XII-18-69	IV-22-70	VI-17-70	VII-14-70	VIII-14-70	I-4-71	II-22-71											
Harmothoe extenuata					2	11		2		1											
Lepidonotus squamatus																					
Pholoe minuta						3	60	2													
Sigalion arenicola																					
Sthenelais boa	1							2	1												
Eteone longa			1																		
Eumida sanguinea	4		1			1	32	9	4	9											
Paranaitis speciosa						1															
Phyllodoce arenae	4	1		1		1	5	12													
Phyllodoce maculata																					
Gyptis vittata																					
Microphthalmus aberrans	2	2	5		1	17	5														
Microphthalmus sczelkowii							1														
Podarke obscura	3					1		1		1											
Ancistrosyllis groenlandica		1				3	5	1													
Ancistrosyllis hartmanae																					
Cabira incerta								1		1											
Autolytus fasciatus																					
Brania clavata		2	6	1		2	4	5													
Brania wellfleetensis	88	79	100	52	40	172	57	97	15	4											
Exogone dispar	50	44	92	20	14	40	10	13	9	26											
Exogone verugera	107	115	77	204	149	371	290	29	122	2											
Odontosyllis fulgarens			2					2													
Parapionosyllis longicirrata	291	279	298	208	246	451	134	128	48	10											
Sphaerosyllis erinaceus	26	14	27	1		5	3	24	55	11											
Sphaerosyllis hystrix	55	123	242	174	39	38	57	81	478	153											
Syllides verrilli	25	116	106	20	19	54	19	71	89	5											
Syllis gracilis																					
Nereis arenaceodonta																					
Nereis grayi																					
Nereis larvae																					
Nereis succinea																					
Nereis virens																					
Platynereis dumerilii	5						1	8													
Micronephthys minuta																					
Nephtys incisa																					
Nephtys picta	7	16	6	19	13	24	11	1	21	5											
Ephesiella minuta		6	5	16	7	1		1	11												
Glycera americana	2	8	7	2	2	5	9	4	6	6											
Glycinde solitaria									5	48											
Diopatra cuprea																					
Onuphis conchylega							27														
Onuphis quadricuspis								1													
Marphysa sanguinea																					
Lumbrinereis coccinea																					
Lumbrinereis fragilis																					
Lumbrinereis tenuis	21	34	20	21	25	81	27	1	7												
Ninoe nigripes										1											
Arabella iricolor																					
Protodorvillea gaspeensis	53	70	71	90	47	111	71		48	23											
Stauronereis caeca	2		18	11	28	18	7	1	2												
Stauronereis ruldolphi																					
Scoloplos acutus	1						3	5	1												
Scoloplos fragilis																					
Scoloplos robustus																					

A(5)

STATION—5 (cont.) POLYCHAETES

SPECIES	IX-27-69	X-22-69	XI-19-69	XII-18-69	IV-22-70	VI-17-70	VII-14-70	VIII-14-70	I-4-71	II-22-71
Aedicira belgicae								1		
Aricidea jeffreysii	202	232	118	70	67	189	171	171	133	8
Aricidea quadrilobata										
Aricidea suecica										
Cirrophorus lyriformis										
Paraonis fulgens										
Paraonis gracilis							1			1
Paraonis lyra										
Dispio uncinata										
Polydora caulleryi										
Polydora ligni			2		2					
Polydora websteri										
Prionospio cirrifera	1							1		
Prionospio heterobranchia		2							3	
Pygospio elegans										
Scolelepis texana								1		
Spio filicornis			1				1		1	
Spionid larvae										
Spiophanes bombyx	1	1	3	1	5	2		1	9	
Spiophanes wigleyi										
Streblospio benedicti										
Magelona sp.										
Spiochaetopterus oculatus	9									
Caulleriella sp.	1	11		4	4	5			1	
Chaetozone sp.	18	8	19	17	11	15	55	157	3	71
Flabelligera affinis										
Pherusa affinis										
Scalibregma inflatum					1					
Capitella capitata	3		1			1	8			
Heteromastus filiformis										
Mediomastus ambiseta	34		31	18	7	6	1086	11,586	726	1045
Notomastus latericeus										2
Notomastus luridus										
Maldanopsis elongata			1	2			1	2	2	7
Praxillella praetermissa			3		1	10	1	1		
Sabellaria vulgaris	4			1				1	4	2
Pectinaria gouldii		1					289	10	1	1
Amage auricula										
Ampharete acutifrons										
Ampharete arctica			1						4	1
Amphicteis gunneri										
Asabellides oculata										
Melinna cristata			2	1	13	24	6	5	4	3
Pista cristata	2	1								
Pista palmata	1							3		
Polycirrus eximius	13				3	7	9			
Fabricia sabella							2			
Potamilla neglecta								1		
Sabella microphthalma								2		
Filigrana implexa										
Hydroides dianthus			1							
Spirorbis borealis										
Spirorbis granulatus										
Spirorbis violaceus										
TOTAL INDIVIDUALS	1036	1166	1268	954	746	1670	2468	12,445	1811	1447
TOTAL SPECIES	31	23	30	23	24	31	34	40	29	26

STATION-7 **POLYCHAETES** **SAMPLE SIZE $\frac{1}{25}$ M^2**

SPECIES	IX-23-69	X-14-69	XI-13-69	XII-17-69	XII-17-69			
Harmothoe extenuata		1		1				
Lepidonotus squamatus								
Pholoe minuta								
Sigalion arenicola								
Sthenelais boa								
Eteone longa								
Eumida sanguinea	4	1	3		1			
Paranaitis speciosa								
Phyllodoce arenae	2	7		5	1			
Phyllodoce maculata								
Gyptis vittata								
Microphthalmus aberrans								
Microphthalmus sczelkowii	1	1	3					
Podarke obscura			1					
Ancistrosyllis groenlandica								
Ancistrosyllis hartmanae				1				
Cabira incerta								
Autolytus fasciatus								
Brania clavata	8	3	4					
Brania wellfleetensis	60							
Exogone dispar	4	2	15	48	4			
Exogone verugera					6			
Odontosyllis fulgarens								
Parapionosyllis longicirrata	20	2	7	58	10			
Sphaerosyllis erinaceus	5	19	63	95	8			
Sphaerosyllis hystrix	6	33	76	68	38			
Syllides verrilli	32	13	49	57	52			
Syllis gracilis								
Nereis arenaceodonta	1							
Nereis grayi		1						
Nereis larvae								
Nereis succinea								
Nereis virens								
Platynereis dumerilii			1	3				
Micronephthys minuta								
Nephtys incisa								
Nephtys picta	2	4	1		2			
Ephesiella minuta								
Glycera americana	4	6	9	6	4			
Glycinde solitaria								
Diopatra cuprea								
Onuphis conchylega								
Onuphis quadricuspis								
Marphysa sanguinea								
Lumbrinereis coccinea								
Lumbrinereis fragilis				2				
Lumbrinereis tenuis	1	1	2	1	7			
Ninoe nigripes			4	1				
Arabella iricolor								
Protodorvillea gaspeensis	12		8					
Stauronereis caeca								
Stauronereis ruldolphi								
Scoloplos acutus		1						
Scoloplos fragilis								
Scoloplos robustus								

STATION-7 (cont.) **POLYCHAETES**

SPECIES	IX-23-69	X-14-69	XI-13-69	XII-17-69	XII-17-69			
Aedicira belgicae								
Aricidea jeffreysii	20	19	19	24	13			
Aricidea quadrilobata								
Aricidea suecica								
Cirrophorus lyriformis								
Paraonis fulgens								
Paraonis gracilis	1	1						
Paraonis lyra								
Dispio uncinata								
Polydora caulleryi								
Polydora ligni	2	7			1			
Polydora websteri								
Prionospio cirrifera		5			6			
Prionospio heterobranchia								
Pygospio elegans								
Scolelepis texana								
Spio filicornis								
Spionid larvae					1			
Spiophanes bombyx	5	2	3					
Spiophanes wigleyi								
Streblospio benedicti								
Magelona sp.								
Spiochaetopterus oculatus	6							
Caulleriella sp.	10	6	6					
Chaetozone sp.	1	26	23	11	6			
Flabelligera affinis								
Pherusa affinis								
Scalibregma inflatum								
Capitella capitata	2	9		1	5			
Heteromastus filiformis								
Mediomastus ambiseta	25	77	10	4				
Notomastus latericeus		3	2					
Notomastus luridus								
Maldanopsis elongata					1			
Praxillella praetermissa								
Sabellaria vulgaris								
Pectinaria gouldii	1							
Amage auricula								
Ampharete acutifrons								
Ampharete arctica								
Amphicteis gunneri								
Asabellides oculata								
Melinna cristata								
Pista cristata								
Pista palmata								
Polycirrus eximius								
Fabricia sabella								
Potamilla neglecta								
Sabella microphthalma								
Filigrana implexa								
Hydroides dianthus								
Spirorbis borealis								
Spirorbis granulatus								
Spirorbis violaceus								

TOTAL INDIVIDUALS	235	250	309	386	166			
TOTAL SPECIES	25	25	21	17	17			

STATION—8 POLYCHAETES SAMPLE SIZE $^1/_{25}$ M^2

SPECIES		IX-27-69	X-22-69					
Harmothoe extenuata								
Lepidonotus squamatus								
Pholoe minuta								
Sigalion arenicola								
Sthenelais boa								
Eteone longa								
Eumida sanguinea								
Paranaitis speciosa								
Phyllodoce arenae		1	1					
Phyllodoce maculata								
Gyptis vittata								
Microphthalmus aberrans								
Microphthalmus sczelkowii		3						
Podarke obscura		6	4					
Ancistrosyllis groenlandica								
Ancistrosyllis hartmanae		1						
Cabira incerta								
Autolytus fasciatus								
Brania clavata		3	7					
Brania wellfleetensis		8	7					
Exogone dispar		6	9					
Exogone verugera		1						
Odontosyllis fulgarens								
Parapionosyllis longicirrata		36	93					
Sphaerosyllis erinaceus		1	10					
Sphaerosyllis hystrix								
Syllides verrilli		14	75					
Syllis gracilis								
Nereis arenaceodonta		1	1					
Nereis grayi		2						
Nereis larvae								
Nereis succinea								
Nereis virens								
Platynereis dumerilii		3						
Micronephthys minuta								
Nephtys incisa								
Nephtys picta								
Ephesiella minuta								
Glycera americana			2					
Glycinde solitaria								
Diopatra cuprea								
Onuphis conchylega								
Onuphis quadricuspis								
Marphysa sanguinea								
Lumbrinereis coccinea								
Lumbrinereis fragilis								
Lumbrinereis tenuis		5	8					
Ninoe nigripes								
Arabella iricolor								
Protodorvillea gaspeensis								
Stauronereis caeca			2					
Stauronereis ruldolphi								
Scoloplos acutus								
Scoloplos fragilis								
Scoloplos robustus								

STATION—8 (cont.) POLYCHAETES

SPECIES		IX-27-69	X-22-69						
Aedicira belgicae									
Aricidea jeffreysii		27	3						
Aricidea quadrilobata									
Aricidea suecica									
Cirrophorus lyriformis									
Paraonis fulgens									
Paraonis gracilis									
Paraonis lyra									
Dispio uncinata									
Polydora caulleryi									
Polydora ligni									
Polydora websteri									
Prionospio cirrifera		1							
Prionospio heterobranchia		38	31						
Pygospio elegans									
Scolelepis texana									
Spio filicornis									
Spionid larvae		3	3						
Spiophanes bombyx		1	1						
Spiophanes wigleyi									
Streblospio benedicti									
Magelona sp.									
Spiochaetopterus oculatus		4							
Caulleriella sp.		6	14						
Chaetozone sp.									
Flabelligera affinis									
Pherusa affinis									
Scalibregma inflatum									
Capitella capitata			13						
Heteromastus filiformis									
Mediomastus ambiseta		5	1						
Notomastus latericeus									
Notomastus luridus									
Maldanopsis elongata									
Praxillella praetermissa									
Sabellaria vulgaris									
Pectinaria gouldii									
Amage auricula									
Ampharete acutifrons									
Ampharete arctica									
Amphicteis gunneri									
Asabellides oculata									
Melinna cristata									
Pista cristata									
Pista palmata									
Polycirrus eximius		29	1						
Fabricia sabella									
Potamilla neglecta									
Sabella microphthalma		3							
Filigrana implexa									
Hydroides dianthus									
Spirorbis borealis									
Spirorbis granulatus									
Spirorbis violaceus									

TOTAL INDIVIDUALS		208	286						
TOTAL SPECIES		24	19						

STATION–9　　POLYCHAETES　　SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-24-69	X-14-69	XI-17-69	XII-18-69	IV-8-70	V-15-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-12-70	XII-22-70	II-19-71	IV-26-71	VI-9-71	VIII-24-71	XII-29-71	III-23-72			
Harmothoe extenuata						2	1							9	3	3		1			
Lepidonotus squamatus																					
Pholoe minuta															4						
Sigalion arenicola																					
Sthenelais boa									1							2					
Eteone longa		1	1						3	1	2		1	1							
Eumida sanguinea		1							5	21	2	8	2	2				1			
Paranaitis speciosa														1							
Phyllodoce arenae	3	3				1			5	3						5	1	1			
Phyllodoce maculata																					
Gyptis vittata												1				2	10				
Microphthalmus aberrans							2			2						1					
Microphthalmus sczelkowii																5					
Podarke obscura										1	1		1								
Ancistrosyllis groenlandica																					
Ancistrosyllis hartmanae																					
Cabira incerta																					
Autolytus fasciatus																					
Brania clavata			1															3			
Brania wellfleetensis											1			5	1			1			
Exogone dispar	1	1					1				1		3		2	1					
Exogone verugera											1										
Odontosyllis fulgarens																					
Parapionosyllis longicirrata	4	15				1	1				1		2	3	1	2		1			
Sphaerosyllis erinaceus	1	2	4			1			5	20	28	39		1		3	25	11			
Sphaerosyllis hystrix	1	5	5	11	2	1	3		7	69	120	202	31	7	9	6	66	96			
Syllides verrilli	9	64	28	21	21	17	16		39	4	5	4	17	54	8	12	5	12			
Syllis gracilis																					
Nereis arenaceodonta			1																		
Nereis grayi									2												
Nereis larvae																					
Nereis succinea																9	1				
Nereis virens											1										
Platynereis dumerilii	4	2							1												
Micronephthys minuta																					
Nephtys incisa	4	1	4		6	22	40	29	13	10	6	35	13	15	20	4	1	4			
Nephtys picta	1	8	1	3		10	8				8			4	3						
Ephesiella minuta												1									
Glycera americana	2	4							4	27	13	1	1	3	1	5	1	1			
Glycinde solitaria									2	129	90	60	16	14	3	13	33	15			
Diopatra cuprea											1	1			1						
Onuphis conchylega																					
Onuphis quadricuspis									6												
Marphysa sanguinea																					
Lumbrinereis coccinea																					
Lumbrinereis fragilis									1												
Lumbrinereis tenuis				1			2				2	1			1		1	2			
Ninoe nigripes	2	4		1											2		2				
Arabella iricolor																					
Protodorvillea gaspeensis			1						3	1	3	3	10	3	1	7	3	4			
Stauronereis caeca										1											
Stauronereis ruldolphi																					
Scoloplos acutus																3					
Scoloplos fragilis																					
Scoloplos robustus											1										

STATION—9 (cont.) POLYCHAETES

SPECIES	IX-24-69	X-14-69	XI-17-69	XII-18-69	IV-8-70	V-15-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-12-70	XII-22-70	II-19-71	IV-26-71	VI-9-71	VIII-24-71	XII-29-71	III-23-72			
Aedicira belgicae																					
Aricidea jeffreysii	4	3		1	1		6			1			1		4	8		4			
Aricidea quadrilobata																					
Aricidea suecica																					
Cirrophorus lyriformis																					
Paraonis fulgens																					
Paraonis gracilis	1																				
Paraonis lyra																					
Dispio uncinata																					
Polydora caulleryi					7	1															
Polydora ligni							1	7	2						1						
Polydora websteri																					
Prionospio cirrifera					1				1	35	77	73	20	6	23	315	290	39			
Prionospio heterobranchia							2														
Pygospio elegans																					
Scolelepis texana									3												
Spio filicornis													3	7				3			
Spionid larvae					8																
Spiophanes bombyx	1										1		1			1	2	3			
Spiophanes wigleyi																					
Streblospio benedicti								4	20												
Magelona sp.																					
Spiochaetopterus oculatus	6																				
Caulleriella sp.																					
Chaetozone sp.	10	16	4	2	2		3	2	91	50	32	24	33	36	9	83	3	1			
Flabelligera affinis			1	1			1								5						
Pherusa affinis																					
Scalibregma inflatum																					
Capitella capitata	2	6	2			6		1						2	3						
Heteromastus filiformis																					
Mediomastus ambiseta	155	39	8			1	3	249	7,873	9,571	4,657	4,484	2,008	2,866	709	1,117	560	647			
Notomastus latericeus																	7	3			
Notomastus luridus											1										
Maldanopsis elongata	2	4		1					1			1		1	3			7			
Praxillella praetermissa		4		2				3								1	41	41			
Sabellaria vulgaris											1										
Pectinaria gouldii	3							23		1						59	13				
Amage auricula																					
Ampharete acutifrons																					
Ampharete arctica												1				1	5				
Amphicteis gunneri																					
Asabellides oculata									1												
Melinna cristata	1										4				3		2	4			
Pista cristata																					
Pista palmata																					
Polycirrus eximius													1	1	1			8			
Fabricia sabella																					
Potamilla neglecta							1														
Sabella microphthalma																					
Filigrana implexa																					
Hydroides dianthus																					
Spirorbis borealis																					
Spirorbis granulatus																					
Spirorbis violaceus																					
TOTAL INDIVIDUALS	217	183	61	44	48	63	91	318	9,097	9,947	5060	4,939	2,164	3,061	821	1,668	1,062	913			
TOTAL SPECIES	21	19	13	10	7	11	16	8	23	18	26	17	18	21	25	25	21	25			

STATION—10 **POLYCHAETES** **SAMPLE SIZE $\frac{1}{25}$ M^2**

SPECIES	IX-22-69	X-14-69	XI 17-69	XII-18-69	IV-6-70	V-10-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71	VI-10-71	VIII-24-71	XII-29-71	XII-29-71	III-23-72	III-23-72		
Harmothoe extenuata					1				1					7	3	1		9	2		
Lepidonotus squamatus											1										
Pholoe minuta								2	1					6							
Sigalion arenicola															1						
Sthenelais boa									2	1	1										
Eteone longa	2	2	1	2		1			8	6		5	1			2					
Eumida sanguinea							1		3	11	14	45	6		2	37	11	4	1		
Paranaitis speciosa															1						
Phyllodoce arenae		3	1						8	5							1				
Phyllodoce maculata																					
Gyptis vittata															2						
Microphthalmus aberrans							2		3				5	6	1	1	1				
Microphthalmus sczelkowii														1		22			6		
Podarke obscura	1									14		2	3		29		3	1	12		
Ancistrosyllis groenlandica															1						
Ancistrosyllis hartmanae																	1				
Cabira incerta																					
Autolytus fasciatus																					
Brania clavata	1	3		2								8	7			4		4	1		
Brania wellfleetensis					2						2		6	1		1		5	7		
Exogone dispar		1							11	4	2	2	9	1	1	2	2	6	4		
Exogone verugera						1								2				3			
Odontosyllis fulgarens																					
Parapionosyllis longicirrata					1					1	1	1	7	1	1	8		5	1		
Sphaerosyllis erinaceus	1	1		6	8		1		74	38	36	46	47			47	33	30	10		
Sphaerosyllis hystrix	11	32	48	51	23	4	4	3	179	172	93	325	234	10	1	177	113	147	117		
Syllides verrilli	10	62	144	177	80	53	14	5	56	5	4	7	20	2	5	12	3	66	51		
Syllis gracilis													1			1					
Nereis arenaceodonta																					
Nereis grayi											1										
Nereis larvae						1				5											
Nereis succinea																7	3	9	5		
Nereis virens									2				1								
Platynereis dumerilii	1															1					
Micronephthys minuta		1																			
Nephtys incisa	6	3	2	9	9	19	55	49	8	11	9	28	3	7		2	1		4		
Nephtys picta			3			13	1			13				2				3	1		
Ephesiella minuta													1					1	1		
Glycera americana		3	1	2					2	15	13	8	7	2	1	6	2	4	6		
Glycinde solitaria								1	17	163	92	90	14			26	44	2	6		
Diopatra cuprea								2		2	2		1								
Onuphis conchylega																					
Onuphis quadricuspis																					
Marphysa sanguinea																					
Lumbrinereis coccinea																					
Lumbrinereis fragilis				1					4				2								
Lumbrinereis tenuis							1						6								
Ninoe nigripes						1															
Arabella iricolor				2						1											
Protodorvillea gaspeensis							1		6	7	6	7	14	2		21	13	3	3		
Stauronereis caeca									1			1						1	2		
Stauronereis ruldolphi															8						
Scoloplos acutus																					
Scoloplos fragilis										1											
Scoloplos robustus																					

STATION— 10 (cont.)

POLYCHAETES

SPECIES	IX-22-69	X-14-69	XI-17-69	XII-18-69	IV-6-70	V-10-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71	VI-10-71	VIII-24-71	XII-29-71	XII-29-71	II-23-72	III-23-72		
Aedicira belgicae																					
Aricidea jeffreysii	11	6			2				55		1		10	2		1		1	1		
Aricidea quadrilobata										1											
Aricidea suecica						1															
Cirrophorus lyriformis																					
Paraonis fulgens																					
Paraonis gracilis																	1				
Paraonis lyra																					
Dispio uncinata			3		1												1				
Polydora caulleryi																					
Polydora ligni	1					1		2	5								1	2	6		
Polydora websteri																					
Prionospio cirrifera		1				1	4		1	105	6	89	5	4		222	155	13	89		
Prionospio heterobranchia						1			1				1	6	2			1	1		
Pygospio elegans																					
Scolelepis texana									14												
Spio filicornis											1							2	3		
Spionid larvae																					
Spiophanes bombyx			1		1							1	1			1					
Spiophanes wigleyi																					
Streblospio benedicti						2		5	1				2			1			3		
Magelona sp.													1								
Spiochaetopterus oculatus	11		2	1				1	7			1									
Caulleriella sp.						1										1					
Chaetozone sp.	4	6	9	9	5	1	3	5	153		43	27	48	11	16	3	1	2	2		
Flabelligera affinis																7		5	3		
Pherusa affinis																					
Scalibregma inflatum																					
Capitella capitata	6		1	1		1	7	1	30	2				3	92	3	1	4	2		
Heteromastus filiformis																					
Mediomastus ambiseta	414	125	6	7	18	3	5	702	22,686	5,226	5,830	3500	1200	1,178	42	498	263	651	463		
Notomastus latericeus				1										1							
Notomastus luridus																			2		
Maldanopsis elongata	3	5	1	7			1		6	2			1		1	4	8	24	28		
Praxillella praetermissa								1	4				1	2		8	18		1		
Sabellaria vulgaris																	1	1			
Pectinaria gouldii	1	1						63	70		2					4	5	2	16		
Amage auricula																					
Ampharete acutifrons								1													
Ampharete arctica																		1			
Amphicteis gunneri																	5				
Asabellides oculata																					
Melinna cristata		1					1		4			1	4	1		4			3		
Pista cristata																					
Pista palmata									1												
Polycirrus eximius														1				2	2		
Fabricia sabella																					
Potamilla neglecta									1	1											
Sabella microphthalma																					
Filigrana implexa																	1				
Hydroides dianthus										1		1									
Spirorbis borealis																					
Spirorbis granulatus																			1		
Spirorbis violaceus																					
TOTAL INDIVIDUALS	484	256	223	278	151	105	101	843	23,425	5,813	6,160	4,195	1,669	1,259	210	1135	692	1014	866		
TOTAL SPECIES	16	17	14	15	12	17	15	15	34	26	21	21	32	24	19	32	27	32	36		

STATION— 20 POLYCHAETES SAMPLE SIZE $^1/_{25}$ M^2

SPECIES	IX-24-69	X-16-69	XI-13-69	XII-18-69	I-6-70	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71						
Harmothoe extenuata			1			3	1	3	10		1		1								
Lepidonotus squamatus																					
Pholoe minuta									1	64											
Sigalion arenicola																					
Sthenelais boa								1					3								
Eteone longa																					
Eumida sanguinea	2	9	4	2			5	1		26		10	4	5	3						
Paranaitis speciosa																					
Phyllodoce arenae	3	9	1		1	3				19	8	5	1		1						
Phyllodoce maculata																					
Gyptis vittata												1									
Microphthalmus aberrans									1	3	14	4	1								
Microphthalmus sczelkowii																					
Podarke obscura	1	5						1		1		7	1								
Ancistrosyllis groenlandica			1																		
Ancistrosyllis hartmanae					1			1				4	1								
Cabira incerta				1			1						1								
Autolytus fasciatus																					
Brania clavata						1					2										
Brania wellfleetensis	111	226	71	49	89	20	52	18	128	122	131	131	67	18	51						
Exogone dispar	22	126	75	80	69	7	22	17	20	21	3	20	70	8	46						
Exogone verugera	27	111	33	61	22	154	119	129	56	183	139	54	76	151	86						
Odontosyllis fulgarens						1							1								
Parapionosyllis longicirrata	377	794	377	338	485	441	278	293	151	228	219	220	231	246	208						
Sphaerosyllis erinaceus	5	60	26	24	7	4	12	4		8	13	108	108	29	4						
Sphaerosyllis hystrix	34	174	182	159	278	48	67	25	19	64	26	228	309	327	90						
Syllides verrilli	6	124	137	59	99	6	54	5	22	16	34	85	30	40	52						
Syllis gracilis								1													
Nereis arenaceodonta						1															
Nereis grayi																					
Nereis larvae																					
Nereis succinea																					
Nereis virens																					
Platynereis dumerilii																					
Micronephthys minuta																					
Nephtys incisa				1											1						
Nephtys picta	6	23	8	9	6	13	3	12	22	11	5	34	18	8	9						
Ephesiella minuta	1	7	2	2	1	4	4		1	5		7	5	13	10						
Glycera americana	2	15	9	11	14	4	4	2	4	12	12	21	13	8	9						
Glycinde solitaria		2										47	14	13	7						
Diopatra cuprea																					
Onuphis conchylega										19											
Onuphis quadricuspis																					
Marphysa sanguinea						1				26			2								
Lumbrinereis coccinea																					
Lumbrinereis fragilis			5																		
Lumbrinereis tenuis	56	124	115	97	146	133	1	27	44	46	15	19	47	9	64						
Ninoe nigripes																					
Arabella iricolor																					
Protodorvillea gaspeensis	60	149	100	70	116	58	48	70	85	57	48	92	88	49	52						
Stauronereis caeca	8	4	10	6			6	20	2	2	5	5	3		1						
Stauronereis ruldolphi																					
Scoloplos acutus	4								1		10	1		1	1						
Scoloplos fragilis																					
Scoloplos robustus																					

STATION—20 (cont.) POLYCHAETES

SPECIES	IX-24-69	X-16-69	XI-13-69	XII-18-69	I-6-70	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71
Aedicira belgicae															
Aricidea jeffreysii	58	145	31	18	25	45	84	23	55	107	295	73	94	68	52
Aricidea quadrilobata															
Aricidea suecica															
Cirrophorus lyriformis															
Paraonis fulgens															
Paraonis gracilis									1						
Paraonis lyra															
Dispio uncinata		1													2
Polydora caulleryi							2								
Polydora ligni	1	1			1				2			1	1		
Polydora websteri															
Prionospio cirrifera					2							6	4		
Prionospio heterobranchia	3	3	11	2				1			5		4	2	1
Pygospio elegans													1		
Scolelepis texana												1	2		
Spio filicornis			2		8		1	1						1	
Spionid larvae															
Spiophanes bombyx	1	10	2	5		2	1	2	1	3	3	10	7		1
Spiophanes wigleyi													2		
Streblospio benedicti															
Magelona sp.		1													
Spiochaetopterus oculatus	2	2				1				1	3	2			
Caulleriella sp.	12	54	27	4	13	9			4	2	41	9	13		49
Chaetozone sp.	24	32	13	27	46	1	17		8	20		56	64	30	
Flabelligera affinis										1					
Pherusa affinis															
Scalibregma inflatum															
Capitella capitata											6				
Heteromastus filiformis															
Mediomastus ambiseta	16	41	33	27	34	21	37	4	31	1338	4548	3700	1824	1091	452
Notomastus latericeus										2		12	4		
Notomastus luridus															
Maldanopsis elongata		1	2			1	1		1			1	5	2	6
Praxillella praetermissa				1	17		3		1			1			
Sabellaria vulgaris			1												
Pectinaria gouldii		2								271	1	9			
Amage auricula															
Ampharete acutifrons															
Ampharete arctica	1	2		10	19		11	13	5	12		3	4		
Amphicteis gunneri															
Asabellides oculata															
Melinna cristata						9					2	2	1	24	5
Pista cristata															
Pista palmata		3										2	1		
Polycirrus eximius	8	22		1	2			3	1						2
Fabricia sabella		1													
Potamilla neglecta															
Sabella microphthalma											1				
Filigrana implexa															
Hydroides dianthus		1	1												
Spirorbis borealis															
Spirorbis granulatus															
Spirorbis violaceus															
TOTAL INDIVIDUALS	851	2284	1280	1064	1501	991	834	677	677	2690	5590	4991	3126	2143	1265
TOTAL SPECIES	27	34	28	25	24	26	25	25	27	30	27	37	40	22	27

STATION-28 POLYCHAETES *ALL TRAWL SAMPLES

SPECIES		IX-19*-69	IX-27*-69	I-6*-70				
Harmothoe extenuata								
Lepidonotus squamatus								
Pholoe minuta								
Sigalion arenicola		1						
Sthenelais boa		6						
Eteone longa		3						
Eumida sanguinea			3					
Paranaitis speciosa								
Phyllodoce arenae		7	1	1				
Phyllodoce maculata								
Gyptis vittata								
Microphthalmus aberrans								
Microphthalmus sczelkowii								
Podarke obscura			1					
Ancistrosyllis groenlandica								
Ancistrosyllis hartmanae								
Cabira incerta								
Autolytus fasciatus								
Brania clavata			4	1				
Brania wellfleetensis								
Exogone dispar		1		1				
Exogone verugera								
Odontosyllis fulgarens								
Parapionosyllis longicirrata								
Sphaerosyllis erinaceus				1				
Sphaerosyllis hystrix								
Syllides verrilli			2					
Syllis gracilis								
Nereis arenaceodonta		5						
Nereis grayi		4	1					
Nereis larvae								
Nereis succinea								
Nereis virens		1						
Platynereis dumerilii		25	29	2				
Micronephthys minuta								
Nephtys incisa								
Nephtys picta		63						
Ephesiella minuta								
Glycera americana		13						
Glycinde solitaria								
Diopatra cuprea		6						
Onuphis conchylega								
Onuphis quadricuspis								
Marphysa sanguinea								
Lumbrinereis coccinea								
Lumbrinereis fragilis								
Lumbrinereis tenuis		67						
Ninoe nigripes								
Arabella iricolor		3						
Protodorvillea gaspeensis								
Stauronereis caeca								
Stauronereis ruldolphi								
Scoloplos acutus								
Scoloplos fragilis								
Scoloplos robustus								

STATION-28 (cont.) POLYCHAETES *ALL TRAWL SAMPLES

SPECIES		IX-19*-69	IX-27*-69	I-6*-70					
Aedicira belgicae									
Aricidea jeffreysii									
Aricidea quadrilobata									
Aricidea suecica									
Cirrophorus lyriformis									
Paraonis fulgens		488	7						
Paraonis gracilis									
Paraonis lyra									
Dispio uncinata									
Polydora caulleryi									
Polydora ligni			17	2					
Polydora websteri									
Prionospio cirrifera									
Prionospio heterobranchia									
Pygospio elegans									
Scolelepis texana									
Spio filicornis									
Spionid larvae									
Spiophanes bombyx			4						
Spiophanes wigleyi									
Streblospio benedicti									
Magelona sp.			5						
Spiochaetopterus oculatus			1						
Caulleriella sp.									
Chaetozone sp.		1	2						
Flabelligera affinis									
Pherusa affinis									
Scalibregma inflatum									
Capitella capitata		1	1						
Heteromastus filiformis									
Mediomastus ambiseta		34							
Notomastus latericeus				1					
Notomastus luridus									
Maldanopsis elongata									
Praxillella praetermissa		13							
Sabellaria vulgaris									
Pectinaria gouldii									
Amage auricula									
Ampharete acutifrons									
Ampharete arctica									
Amphicteis gunneri									
Asabellides oculata									
Melinna cristata									
Pista cristata									
Pista palmata									
Polycirrus eximius									
Fabricia sabella									
Potamilla neglecta									
Sabella microphthalma									
Filigrana implexa									
Hydroides dianthus		1							
Spirorbis borealis									
Spirorbis granulatus									
Spirorbis violaceus									
TOTAL INDIVIDUALS		743	78	9					
TOTAL SPECIES		20	14	7					

*ALL TRAWL SAMPLES

STATION–30 POLYCHAETES SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-27-69	X-10-69	XI-17-69	XII-17-69	VI-17-70	IX-30-70	II-22-71		
Harmothoe extenuata					4				
Lepidonotus squamatus									
Pholoe minuta					1				
Sigalion arenicola									
Sthenelais boa							1		
Eteone longa	1					2			
Eumida sanguinea		6				29			
Paranaitis speciosa									
Phyllodoce arenae		1			1	2			
Phyllodoce maculata									
Gyptis vittata									
Microphthalmus aberrans				1		2			
Microphthalmus sczelkowii					2				
Podarke obscura		2				10			
Ancistrosyllis groenlandica									
Ancistrosyllis hartmanae	2				1				
Cabira incerta				1					
Autolytus fasciatus									
Brania clavata					1		4		
Brania wellfleetensis	6	4	22	2	36	6	40		
Exogone dispar		3		1	3	3	6		
Exogone verugera						3	1		
Odontosyllis fulgarens									
Parapionosyllis longicirrata	34	94	22		44	49	110		
Sphaerosyllis erinaceus		12	1		2	19	18		
Sphaerosyllis hystrix		1	1		5	48	103		
Syllides verrilli	7	24	24	154	58	175	87		
Syllis gracilis									
Nereis arenaceodonta	1		1						
Nereis grayi									
Nereis larvae									
Nereis succinea									
Nereis virens									
Platynereis dumerilii		9				3			
Micronephthys minuta									
Nephtys incisa									
Nephtys picta		1		1	5	4	2		
Ephesiella minuta						1			
Glycera americana					2	20	3		
Glycinde solitaria						44	5		
Diopatra cuprea						1	3		
Onuphis conchylega									
Onuphis quadricuspis									
Marphysa sanguinea									
Lumbrinereis coccinea									
Lumbrinereis fragilis									
Lumbrinereis tenuis	5	4			3	2	33		
Ninoe nigripes									
Arabella iricolor									
Protodorvillea gaspeensis	34	14	4	3	17	1	23		
Stauronereis caeca			5		7	4	9		
Stauronereis ruldolphi									
Scoloplos acutus									
Scoloplos fragilis									
Scoloplos robustus									

STATION–30 (cont.) POLYCHAETES

SPECIES	IX-27-69	X-10-69	XI-17-69	XII-17-69	VI-17-70	IX-30-70	II-22-71	
Aedicira belgicae								
Aricidea jeffreysii	57	11	26	18	16		28	
Aricidea quadrilobata								
Aricidea suecica								
Cirrophorus lyriformis								
Paraonis fulgens								
Paraonis gracilis								
Paraonis lyra								
Dispio uncinata							2	
Polydora caulleryi						1		
Polydora ligni		2						
Polydora websteri								
Prionospio cirrifera								
Prionospio heterobranchia						17		
Pygospio elegans								
Scolelepis texana								
Spio filicornis								
Spionid larvae								
Spiophanes bombyx		6		7	1		2	
Spiophanes wigleyi								
Streblospio benedicti								
Magelona sp.								
Spiochaetopterus oculatus	7							
Caulleriella sp.								
Chaetozone sp.	4	2	1	16	2	23	4	
Flabelligera affinis					1			
Pherusa affinis								
Scalibregma inflatum								
Capitella capitata	4		22	17	7	4	7	
Heteromastus filiformis	1							
Mediomastus ambiseta			16			3,042	265	
Notomastus latericeus								
Notomastus luridus								
Maldanopsis elongata							2	
Praxillella praetermissa								
Sabellaria vulgaris								
Pectinaria gouldii		19				4	1	
Amage auricula								
Ampharete acutifrons								
Ampharete arctica								
Amphicteis gunneri							14	
Asabellides oculata								
Melinna cristata								
Pista cristata								
Pista palmata							1	
Polycirrus eximius								
Fabricia sabella							1	
Potamilla neglecta								
Sabella microphthalma								
Filigrana implexa								
Hydroides dianthus								
Spirorbis borealis								
Spirorbis granulatus								
Spirorbis violaceus								

TOTAL INDIVIDUALS	163	215	145	221	219	3519	775	
TOTAL SPECIES	13	18	12	11	22	27	27	

STATION—31 POLYCHAETES SAMPLE SIZE $^1/_{25}$ M^2 EXCEPT WHERE OTHERWISE NOTED

SPECIES	IX-19*-69	IX-25-69	X-24-69	XI-17-69	XII-22-69	III-3†-70	V-12-70	VI-12-70	VII-14-70	VIII-18-70	IX-29-70	XI-10-70	XII-22-70	I-13-71	III-2-71	VI-9-71	VIII-24-71	XII-29-71	III-23-72	IV-3-72	I-19-73
Harmothoe extenuata							10	11	2						3	11			5	1	
Lepidonotus squamatus																					
Pholoe minuta																					
Sigalion arenicola																					
Sthenelais boa	1																				
Eteone longa						0.4			1	4		9		10	1	4	1				4
Eumida sanguinea						2.0	3	5	5	47	26	10	1	9	15	3	3	1	31	2	
Paranaitis speciosa																					
Phyllodoce arenae	1								2	1						1					
Phyllodoce maculata																					
Gyptis vittata											1		1								
Microphthalmus aberrans		7					19	43	206	42			1			15					
Microphthalmus sczelkowii																					
Podarke obscura										1	30	13	3	7	9		7		8		
Ancistrosyllis groenlandica																					
Ancistrosyllis hartmanae																					
Cabira incerta																					
Autolytus fasciatus																					
Brania clavata				1					3												
Brania wellfleetensis																					
Exogoue dispar	1							1			3		1				1		1		1
Exogone verugera																					
Odontosyllis fulgarens																					
Parapionosyllis longicirrata								1	2	1							1				
Sphaerosyllis erinaceus										1									1		
Sphaerosyllis hystrix										1	2										
Syllides verrilli							1		2	4	2	4	2		1		3		2		
Syllis gracilis																					
Nereis arenaceodonta				1									1								
Nereis grayi						0.4		3													
Nereis larvae																					
Nereis succinea			1		2	9.2	10	7	4	1	83	69	14	34	47	17	1	1	28	7	15
Nereis virens	1														1						
Platynereis dumerilii	2	4		1				1		21	18			1			86				
Micronephthys minuta																					
Nephtys incisa																					
Nephtys picta	2							1													
Ephesiella minuta																					
Glycera americana												3									
Glycinde solitaria											2	6							1		
Diopatra cuprea																	3				
Onuphis conchylega																					
Onuphis quadricuspis																					
Marphysa sanguinea																					
Lumbrinereis coccinea																					
Lumbrinereis fragilis																					
Lumbrinereis tenuis																					
Ninoe nigripes																					
Arabella iricolor																					
Protodorvillea gaspeensis																					
Stauronereis caeca																					
Stauronereis ruldolphi										5											
Scoloplos acutus									1												
Scoloplos fragilis	1																				
Scoloplos robustus																					

STATION— 31 (cont.) POLYCHAETES

SPECIES	IX-19*-69	IX-25-69	X-24-69	XI-17-69	XII-22-69	III-3†-70	V-12-70	VI-12-70	VII-14-70	VIII-18-70	IX-29-70	XI-10-70	XII-22-70	I-13-71	III-2-71	VI-9-71	VIII-24-71	XII-29-71	III-23-72	IV-3-72	I-19-73
Aedicira belgicae																					
Aricidea jeffreysii																					
Aricidea quadrilobata																					
Aricidea suecica																					
Cirrophorus lyriformis																					
Paraonis fulgens	1																				
Paraonis gracilis	1																				
Paraonis lyra																					
Diopio uncinata																					
Polydora caulleryi							1		1												
Polydora ligni	1	1			8	9.6	21	313	571	112			3			7	21		1	1	
Polydora websteri							1		4												
Prionospio cirrifera																					
Prionospio heterobranchia										79	62	169	40	17	10		42				
Pygospio elegans																					
Scolelepis texana																					
Spio filicornis							3		1					2				1	26	19	
Spionid larvae													2		6						
Spiophanes bombyx												3									
Spiophanes wigleyi																					
Streblospio benedicti										3			2	1	1		244				42
Magelona sp.																					
Spiochaetopterus oculatus																					
Caulleriella sp.																			1		
Chaetozone sp.	1						1	1	3												
Flabelligera affinis																					
Pherusa affinis																					
Scalibregma inflatum																					
Capitella capitata	60	14		69	533	2450.8	2432	3413	2435	1153	73	27	12	20	7	4	261		20	2	1
Heteromastus filiformis																					
Mediomastus ambiseta								5		1	21	9		2	3		2				2
Notomastus latericeus							6		11												
Notomastus luridus																					
Maldanopsis elongata										6											
Praxillella praetermissa	2																				
Sabellaria vulgaris											1				1				1		
Pectinaria gouldii									4												1
Amage auricula																					
Ampharete acutifrons																					
Ampharete arctica																					
Amphicteis gunneri																					
Asabellides oculata																					
Melinna cristata																					
Pista cristata																					
Pista palmata																					
Polycirrus eximius																					
Fabricia sabella	1																3				
Potamilla neglecta																					
Sabella microphthalma																	3				
Filigrana implexa																					
Hydroides dianthus																					
Spirorbis borealis																					
Spirorbis granulatus																					
Spirorbis violaceus																					
TOTAL INDIVIDUALS	76	26	1	72	543	2472.4	2508	3805	3258	1483	324	322	83	103	105	62	682	3	126	32	66
TOTAL SPECIES	14	4	1	4	3	6	12	13	18	18	13	11	12	10	12	8	16	3	13	6	7

*TRAWL SAMPLE

†ADJUSTED FROM $^1/_{10}$ M^2 VAN VEEN GRAB

STATION—35 POLYCHAETES SAMPLE SIZE $^{1}/_{25}$ M^2

SPECIES	X-16-69	XI-13-69	XII-18-69	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	I-4-71	II-19-71	VIII-25-71							
Harmothoe extenuata				1	16	1	7	1					2	2							
Lepidonotus squamatus																					
Pholoe minuta				2			2	4													
Sigalion arenicola																					
Sthenelais boa														5							
Eteone longa		1										1									
Eumida sanguinea		1	1		2		1	2	2	1		3	9								
Paranaitis speciosa		1	1	3	1					1											
Phyllodoce arenae	2	1					1	2	5		4	1	1	5							
Phyllodoce maculata					1																
Gyptis vittata																					
Microphthalmus aberrans			1	3		1						1		3							
Microphthalmus sczelkowii		1										3	2								
Podarke obscura	1													2							
Ancistrosyllis groenlandica		1																			
Ancistrosyllis hartmanae																					
Cabira incerta																					
Autolytus fasciatus	1																				
Brania clavata	1	8	11	9	11	2	10	2	5	8	7	15	24	14							
Brania wellfleetensis		5	46	4		1		1					26	19							
Exogone dispar	7	13	20	4	7	4	3	3	1	30	14	19	43	13							
Exogone verugera			2										1								
Odontosyllis fulgarens							1														
Parapionosyllis longicirrata		2	81	6	8	5	3	2		2	3	4	7	5							
Sphaerosyllis erinaceus	7	10	31	3	15		7	6	4	19	11	10	42	8							
Sphaerosyllis hystrix	55	84	297	144	112	37	55	35	8	127	72	56	313	23							
Syllides verrilli	13	5	26	14	3	1	6	5	2					2							
Syllis gracilis																					
Nereis arenaceodonta																					
Nereis grayi	2																				
Nereis larvae																					
Nereis succinea			1	1																	
Nereis virens																					
Platynereis dumerilii								1		1			2	1							
Micronephthys minuta																					
Nephtys incisa	4	2	2	12	10	25	11	6	11	7	1	22	10	23							
Nephtys picta	2						3			5											
Ephesiella minuta																					
Glycera americana	4	3	13	8	2			3	1	16	3	4	10	12							
Glycinde solitaria	2		2		2					61	22	50	31	4							
Diopatra cuprea																					
Onuphis conchylega																					
Onuphis quadricuspis																					
Marphysa sanguinea																					
Lumbrinereis coccinea									1					2							
Lumbrinereis fragilis																					
Lumbrinereis tenuis	6	16	1	3	5	10	5	5		6	5	5	3	7							
Ninoe nigripes	12	12	6	8	14	5	5	8	17	7	8	12	6								
Arabella iricolor		1		1																	
Protodorvillea gaspeensis		5	2	1	1		3				2	1		4							
Stauronereis caeca	4																				
Stauronereis ruldolphi																					
Scoloplos acutus							1							3							
Scoloplos fragilis																					
Scoloplos robustus																					

STATION—35 (cont.) POLYCHAETES

SPECIES	X-16-69	XI-13-69	XII-18-69	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	I-4-71	II-19-71	VIII-25-71							
Aedicira belgicae																					
Aricidea jeffreysii	41	31	21	56	59	57	37	54	35	37	48	36	29	16							
Aricidea quadrilobata																					
Aricidea suecica																					
Cirrophorus lyriformis						15								4							
Paraonis fulgens														2							
Paraonis gracilis							13	10		4											
Paraonis lyra									2												
Dispio uncinata																					
Polydora caulleryi					4																
Polydora ligni	1	1						1					2								
Polydora websteri																					
Prionospio cirrifera	6	12	1			2	1	1		20	5	10	2	234							
Prionospio heterobranchia	1		1				4														
Pygospio elegans																					
Scolelepis texana				1							1										
Spio filicornis													1								
Spionid larvae																					
Spiophanes bombyx		1								1	1										
Spiophanes wigleyi																					
Streblospio benedicti																					
Magelona sp.																					
Spiochaetopterus oculatus					1				5					3							
Caulleriella sp.																					
Chaetozone sp.	12	13	38	7	12	11	6	17	29	16	24	15	33	12							
Flabelligera affinis																					
Pherusa affinis			1		2																
Scalibregma inflatum																					
Capitella capitata																					
Heteromastus filiformis																					
Mediomastus ambiseta	394	291	199	416	283	301	371	383	7479	2189	994	731	737	508							
Notomastus latericeus	1									3			8								
Notomastus luridus																					
Maldanopsis elongata	3	2	4	1																	
Praxillella praetermissa		1	6	33	38	35	68	30	13	3	58	11	32	6							
Sabellaria vulgaris																					
Pectinaria gouldii	8				1	1	1	28	1	16	4			9							
Amage auricula																					
Ampharete acutifrons									4												
Ampharete arctica	2			5	31	2	4	1			1			2							
Amphicteis gunneri																					
Asabellides oculata																					
Melinna cristata	6	2	1	5	10	10	7	4		10	7	17	53								
Pista cristata																					
Pista palmata																					
Polycirrus eximius	1					1	4	2	1				1	2							
Fabricia sabella										1				4							
Potamilla neglecta																					
Sabella microphthalma	1								2	5											
Filigrana implexa																					
Hydroides dianthus																					
Spirorbis borealis																					
Spirorbis granulatus																					
Spirorbis violaceus																					
TOTAL INDIVIDUALS	600	526	816	751	653	527	642	617	7628	2596	1285	1027	1430	957							
TOTAL SPECIES	29	26	27	26	26	21	28	27	21	26	22	32	27	32							

STATION–37 POLYCHAETES SAMPLE SIZE $^1/_{25}$ M^2

SPECIES		XI-13-69						
Harmothoe extenuata								
Lepidonotus squamatus								
Pholoe minuta								
Sigalion arenicola								
Sthenelais boa								
Eteone longa								
Eumida sanguinea								
Paranaitis speciosa								
Phyllodoce arenae								
Phyllodoce maculata								
Gyptis vittata								
Microphthalmus aberrans		3						
Microphthalmus sczelkowii								
Podarke obscura		1						
Ancistrosyllis groenlandica								
Ancistrosyllis hartmanae								
Cabira incerta								
Autolytus fasciatus								
Brania clavata								
Brania wellfleetensis								
Exogone dispar								
Exogone verugera								
Odontosyllis fulgarens								
Parapionosyllis longicirrata		63						
Sphaerosyllis erinaceus		5						
Sphaerosyllis hystrix		82						
Syllides verrilli		23						
Syllis gracilis								
Nereis arenaceodonta								
Nereis grayi								
Nereis larvae								
Nereis succinea								
Nereis virens								
Platynereis dumerilii								
Micronephthys minuta								
Nephtys incisa								
Nephtys picta		2						
Ephesiella minuta								
Glycera americana		1						
Glycinde solitaria								
Diopatra cuprea								
Onuphis conchylega								
Onuphis quadricuspis								
Marphysa sanguinea								
Lumbrinereis coccinea								
Lumbrinereis fragilis								
Lumbrinereis tenuis								
Ninoe nigripes								
Arabella iricolor								
Protodorvillea gaspeensis		10						
Stauronereis caeca								
Stauronereis ruldolphi								
Scoloplos acutus								
Scoloplos fragilis								
Scoloplos robustus								

STATION–37 (cont.) POLYCHAETES

SPECIES		XI-13-69						
Aedicira belgicae								
Aricidea jeffreysii		19						
Aricidea quadrilobata								
Aricidea suecica								
Cirrophorus lyriformis								
Paraonis fulgens								
Paraonis gracilis								
Paraonis lyra								
Dispio uncinata								
Polydora caulleryi								
Polydora ligni								
Polydora websteri								
Prionospio cirrifera								
Prionospio heterobranchia								
Pygospio elegans								
Scolelepis texana								
Spio filicornis								
Spionid larvae								
Spiophanes bombyx		2						
Spiophanes wigleyi								
Streblospio benedicti								
Magelona sp.								
Spiochaetopterus oculatus								
Caulleriella sp.		4						
Chaetozone sp.								
Flabelligera affinis								
Pherusa affinis								
Scalibregma inflatum								
Capitella capitata								
Heteromastus filiformis								
Mediomastus ambiseta		215						
Notomastus latericeus								
Notomastus luridus								
Maldanopsis elongata		24						
Praxillella praetermissa								
Sabellaria vulgaris								
Pectinaria gouldii								
Amage auricula								
Ampharete acutifrons								
Ampharete arctica								
Amphicteis gunneri								
Asabellides oculata								
Melinna cristata		3						
Pista cristata								
Pista palmata								
Polycirrus eximius								
Fabricia sabella								
Potamilla neglecta								
Sabella microphthalma								
Filigrana implexa								
Hydroides dianthus								
Spirorbis borealis								
Spirorbis granulatus								
Spirorbis violaceus								

TOTAL INDIVIDUALS		457						
TOTAL SPECIES		15						

STATION-80 POLYCHAETES SAMPLE SIZE $^1/_{25}$ M^2

SPECIES	VI-12-70	XI-18-70	VI-10-71
Harmothoe extenuata	9	1	6
Lepidonotus squamatus			
Pholoe minuta	1		2
Sigalion arenicola			
Sthenelais boa			
Eteone longa	1		
Eumida sanguinea	2	20	6
Paranaitis speciosa		3	
Phyllodoce arenae	1		2
Phyllodoce maculata			
Gyptis vittata			
Microphthalmus aberrans			
Microphthalmus sczelkowii		11	
Podarke obscura		2	2
Ancistrosyllis groenlandica			
Ancistrosyllis hartmanae		1	
Cabira incerta			
Autolytus fasciatus			
Brania clavata	13	23	
Brania wellfleetensis	112	90	1
Exogone dispar	15	12	4
Exogone verugera	5	7	176
Odontosyllis fulgarens			
Parapionosyllis longicirrata	56	131	81
Sphaerosyllis erinaceus	23	34	9
Sphaerosyllis hystrix	59	144	2
Syllides verrilli	39	18	6
Syllis gracilis			
Nereis arenaceodonta			
Nereis grayi			
Nereis larvae			
Nereis succinea			1
Nereis virens			
Platynereis dumerilii		1	
Micronephthys minuta			
Nephtys incisa			
Nephtys picta			
Ephesiella minuta		8	14
Glycera americana	4	9	3
Glycinde solitaria		10	
Diopatra cuprea	2		
Onuphis conchylega			
Onuphis quadricuspis			
Marphysa sanguinea			
Lumbrinereis coccinea			
Lumbrinereis fragilis			
Lumbrinereis tenuis	16	1	22
Ninoe nig[illegible]pes			
Arabella [illegible]ricolor			
Protodo[illegible]illea gaspeensis	86	113	44
Stauronereis caeca			
Stauronereis ruldolphi			
Scoloplos acutus			
Scoloplos fragilis			
Scoloplos robustus			

STATION-80 (cont.) POLYCHAETES

SPECIES	VI-12-70	XI-18-70	VI-10-71
Aedicira belgicae			
Aricidea jeffreysii	80	82	42
Aricidea quadrilobata			
Aricidea suecica			
Cirrophorus lyriformis			
Paraonis fulgens			
Paraonis gracilis			
Paraonis lyra			
Dispio uncinata			
Polydora caulleryi			
Polydora ligni	1		4
Polydora websteri			
Prionospio cirrifera	3	1	2
Prionospio heterobranchia			
Pygospio elegans			
Scolelepis texana			
Spio filicornis			1
Spionid larvae			
Spiophanes bombyx	1	6	1
Spiophanes wigleyi			
Streblospio benedicti			
Magelona sp.			
Spiochaetopterus oculatus			
Caulleriella sp.	1	3	
Chaetozone sp.	49	8	2
Flabelligera affinis	2		1
Pherusa affinis			
Scalibregma inflatum	1		
Capitella capitata	2		
Heteromastus filiformis			
Mediomastus ambiseta	175	393	41
Notomastus latericeus			
Notomastus luridus			
Maldanopsis elongata	20	6	2
Praxillella praetermissa		17	
Sabellaria vulgaris		2	1
Pectinaria gouldii		3	
Amage auricula			
Ampharete acutifrons			
Ampharete arctica		2	
Amphicteis gunneri			
Asabellides oculata			
Melinna cristata	25	7	2
Pista cristata			
Pista palmata			
Polycirrus eximius	44	2	5
Fabricia sabella			
Potamilla neglecta	2		
Sabella microphthalma			
Filigrana implexa			
Hydroides dianthus		4	
Spirorbis borealis			
Spirorbis granulatus			
Spirorbis violaceus			
TOTAL INDIVIDUALS	850	1175	485
TOTAL SPECIES	31	34	29

STATION–90 POLYCHAETES SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	VIII-14-70	XI-18-70	I-4-71	II-22-71	IV-26-71	VI-10-71	VII-2-71	VIII-26-71
Harmothoe extenuata				2	1	2		
Lepidonotus squamatus								
Pholoe minuta						4		
Sigalion arenicola								
Sthenelais boa		1						
Eteone longa	1			1		1		
Eumida sanguinea	3	1	6	1				
Paranaitis speciosa								
Phyllodoce arenae	7		1					
Phyllodoce maculata								
Gyptis vittata		4	8	7	5		2	
Microphthalmus aberrans	4	1						
Microphthalmus sczelkowii				1	9		5	
Podarke obscura		1	1					
Ancistrosyllis groenlandica			1					
Ancistrosyllis hartmanae					1			
Cabira incerta								
Autolytus fasciatus								
Brania clavata								
Brania wellfleetensis					7	1	4	
Exogone dispar				7		2	2	
Exogone verugera		1			3			
Odontosyllis fulgarens								
Parapionosyllis longicirrata			1	6	8	5	1	2
Sphaerosyllis erinaceus	2	1	1	9	6		1	
Sphaerosyllis hystrix	1	2	6	20	26	16	4	1
Syllides verrilli	1				3	5	3	
Syllis gracilis								
Nereis arenaceodonta								
Nereis grayi								
Nereis larvae								
Nereis succinea		1				1		
Nereis virens						1		
Platynereis dumerilii								
Micronephthys minuta								
Nephtys incisa	50	24	61	74	65	173	159	76
Nephtys picta								
Ephesiella minuta				1				
Glycera americana		11	7	5	1	2		
Glycinde solitaria		30	39	19	7	9		
Diopatra cuprea								
Onuphis conchylega								
Onuphis quadricuspis								
Marphysa sanguinea								
Lumbrinereis coccinea								
Lumbrinereis fragilis								
Lumbrinereis tenuis	1	2		6	4	11		
Ninoe nigripes				1				
Arabella iricolor			6					
Protodorvillea gaspeensis	1			1	1			
Stauronereis caeca		1						
Stauronereis ruldolphi							1	
Scoloplos acutus								
Scoloplos fragilis								
Scoloplos robustus								

STATION–90 (cont.) POLYCHAETES

SPECIES	VIII-14-70	XI-18-70	I-4-71	II-22-71	IV-26-71	VI-10-71	VII-2-71	VIII-26-71
Aedicira belgicae								
Aricidea jeffreysii		4	1		3	6	1	
Aricidea quadrilobata								
Aricidea suecica								
Cirrophorus lyriformis			1	1				
Paraonis fulgens								
Paraonis gracilis								
Paraonis lyra								
Dispio uncinata								
Polydora caulleryi								
Polydora ligni					2	2		
Polydora websteri								
Prionospio cirrifera	4	223	274	401	100	118	51	114
Prionospio heterobranchia								
Pygospio elegans								
Scolelepis texana	6							
Spio filicornis			1					2
Spionid larvae								
Spiophanes bombyx			1	1		1		
Spiophanes wigleyi								
Streblospio benedicti	7							
Magelona sp.								
Spiochaetopterus oculatus	6		1					
Caulleriella sp.								
Chaetozone sp.	2	3	2	1	2	3		
Flabelligera affinis						1	1	
Pherusa affinis			3					
Scalibregma inflatum								1
Capitella capitata								
Heteromastus filiformis								
Mediomastus ambiseta	15,965	18,369	14,126	5098	9211	3592	3675	101
Notomastus latericeus			1					
Notomastus luridus								
Maldanopsis elongata	34	12	10	74	11	11		
Praxillella praetermissa	1					27		
Sabellaria vulgaris				1				
Pectinaria gouldii	40	10	4	3	7		1	15
Amage auricula				1				
Ampharete acutifrons								
Ampharete arctica					12			
Amphicteis gunneri								
Asabellides oculata								
Melinna cristata				3		5		1
Pista cristata								
Pista palmata		1						
Polycirrus eximius		1				7		
Fabricia sabella								
Potamilla neglecta								
Sabella microphthalma								
Filigrana implexa								
Hydroides dianthus								
Spirorbis borealis					1			
Spirorbis granulatus								
Spirorbis violaceus								
TOTAL INDIVIDUALS	16,136	18,704	14,565	5745	9496	4006	3911	313
TOTAL SPECIES	19	22	24	26	24	24	15	9

POLYCHAETES SAMPLE SIZE $\frac{1}{128}$ M^2

STATIONS SIPPEWISSETT MARSH

		SIPP 3		SIPP 4		SIPP 7		SIPP 8													
SPECIES		II-24-70		II-24-70		VIII-6-70		VIII-13-70	I-11-71												
Harmothoe extenuata																					
Lepidonotus squamatus																					
Pholoe minuta																					
Sigalion arenicola																					
Sthenelais boa																					
Eteone longa								1													
Eumida sanguinea																					
Paranaitis speciosa																					
Phyllodoce arenae																					
Phyllodoce maculata																					
Gyptis vittata																					
Microphthalmus aberrans																					
Microphthalmus sczelkowii																					
Podarke obscura																					
Ancistrosyllis groenlandica																					
Ancistrosyllis hartmanae																					
Cabira incerta																					
Autolytus fasciatus																					
Brania clavata																					
Brania wellfleetensis																					
Exogone dispar																					
Exogone verugera																					
Odontosyllis fulgurans																					
Parapionosyllis longicirrata																					
Sphaerosyllis erinaceus																					
Sphaerosyllis hystrix																					
Syllides verrilli				2		1			8												
Syllis gracilis																					
Nereis arenaceodonta																					
Nereis grayi																					
Nereis larvae																					
Nereis succinea		6		1				1	2												
Nereis virens																					
Platynereis dumerilii																					
Micronephthys minuta																					
Nephtys incisa																					
Nephtys picta																					
Ephesiella minuta																					
Glycera americana																					
Glycinde solitaria									1												
Diopatra cuprea																					
Onuphis conchylega																					
Onuphis quadricuspis																					
Marphysa sanguinea																					
Lumbrineris coccinea																					
Lumbrineris fragilis																					
Lumbrineris tenuis																					
Ninoe nigripes																					
Arabella iricolor																					
Protodorvillea gaspeensis																					
Stauronereis caeca																					
Stauronereis ruldolphi																					
Scoloplos acutus								11													
Scoloplos fragilis		1						4													
Scoloplos robustus																					

POLYCHAETES

STATIONS SIPPEWISSETT MARSH (CONT.)

SPECIES	SIPP 3	SIPP 4	SIPP 7	SIPP 8	
	II-24-70	II-24-70	VIII-6-70	VIII-13-70	I-11-71
Aedicira belgicae					
Aricidea jeffreysii					
Aricidea quadrilobata					
Aricidea suecica					
Cirrophorus lyriformis					
Paraonis fulgens					
Paraonis gracilis					
Paraonis lyra					
Dispio uncinata					
Polydora caulleryi					
Polydora ligni	1	10	11	2	
Polydora websteri					
Prionospio cirrifera					
Prionospio heterobranchia					
Pygospio elegans					
Scolelepis texana					
Spio filicornis					1
Spionid larvae					
Spiophanes bombyx					
Spiophanes wigleyi					
Streblospio benedicti	17	5	9	62	4
Magelona sp.					
Spiochaetopterus oculatus					
Caulleriella sp.					
Chaetozone sp.					
Flabelligera affinis					
Pherusa affinis					
Scalibregma inflatum					
Capitella capitata			107	27	
Heteromastus filiformis					
Mediomastus ambiseta				1	1
Notomastus latericeus				1	
Notomastus luridus					
Maldanopsis elongata					
Praxillella praetermissa					
Sabellaria vulgaris					
Pectinaria gouldii	2	1	1	7	
Amage auricula					
Ampharete acutifrons					
Ampharete arctica					
Amphicteis gunneri					
Asabellides oculata					
Melinna cristata					
Pista cristata					
Pista palmata					
Polycirrus eximius					
Fabricia sabella		2			
Potamilla neglecta					
Sabella microphthalma					
Filigrana implexa					
Hydroides dianthus					
Spirorbis borealis					
Spirorbis granulatus					
Spirorbis violaceus					
TOTAL INDIVIDUALS	27	21	129	117	17
TOTAL SPECIES	5	6	5	10	6

A(25)

STATION– II

BIVALVES SAMPLE SIZE $^1/_{128}$ M^2

SPECIES	IX-19-69	IX-26-69	XII-7-69	II-24-70	III-31-70	VI-16-70	VIII-3-70	VIII-3-70	X-1-70	I-11-71	III-1-71	X-6-71
Solemya velum												
Nucula annulata												
Nucula delphinodonta												
Nucula proxima												
Yoldia limatula												
Anadara ovalis												
Anadara transversa												
Mytilus edulis												
Aequipecten irradians												
Anomia simplex												
Astarte borealis												
Crassinella mactracea												
Rochefortia cuneata												
Cerastoderma pinnulatum												
Laevicardium mortoni												
Gemma gemma	112						1				1	20
Mercenaria mercenaria		NONE	NONE	NONE						1		
Pitar morrhuana		ALIVE	ALIVE	ALIVE								
Petricola pholadiformis												
Mulinia lateralis												
Macoma balthica					1							
Macoma tenta												
Tellina agilis												1
Cumingia tellinoides												
Tagelus divisus												
Ensis directus												
Mya arenaria							1	1	1		1	5
Corbula contracta												
Corbula swiftiana												
Pandora gouldiana												
Lyonsia hyalina												
Pelecypod sp. B												
Pelecypod sp. C												
Pelecypod larvae						1						
Pelecypod #5												
TOTAL INDIVIDUALS	112	0	0	0	1	1	2	1	1	1	2	26
TOTAL SPECIES	1	0	0	0	1	1	2	1	1	1	2	3

STATION–IV BIVALVES SAMPLE SIZE $\frac{1}{128}$ M^2

SPECIES	IX-21-69	X-9-69*	XII-7-69	II-22-70	IV-19-70	V-20-70	VI-15-70	VII-14-70	VIII-6-70	X-2-70	X-2-70	XI-11-70	XII-8-70	III-1-71	IV-26-71	VI-4-71	VII-8-71	VIII-9-71	XII-17-71	IV-13-72	V-26-72
Solemya velum																					
Nucula annulata																					
Nucula delphinodonta																					
Nucula proxima																					
Yoldia limatula																					
Anadara ovalis																					
Anadara transversa																					
Mytilus edulis																					
Aequipecten irradians																					
Anomia simplex																					
Astarte borealis																					
Crassinella mactracea																					
Rochefortia cuneata																					
Cerastoderma pinnulatum																					
Laevicardium mortoni																					
Gemma gemma	8																	4	9	7	10
Mercenaria mercenaria																		1			
Pitar morrhuana		NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE					NONE ALIVE										
Petricola pholadiformis																					
Mulinia lateralis																					
Macoma balthica								1				1	1	1			3	4			1
Macoma tenta																					
Tellina agilis																					
Cumingia tellinoides																					
Tagelus divisus																					
Ensis directus																					
Mya arenaria							68	19	8	2		5	2		1	3	11	7	1		1
Corbula contracta																					
Corbula swiftiana																					
Pandora gouldiana																					
Lyonsia hyalina																					
Pelecypod sp. B										1										2	
Pelecypod sp. C																					
Pelecypod larvae																					
Pelecypod #5																					
TOTAL INDIVIDUALS	8	0	0	0	0	0	68	20	8	3	0	6	3	1	1	3	14	16	10	9	12
TOTAL SPECIES	1	0	0	0	0	0	1	2	1	2	0	2	2	1	1	1	2	4	2	2	3

*ADJUSTED FROM 12"X 12", SQUARES PUT THROUGH 0.297 mm SCREEN

STATION—5 BIVALVES SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-27-69	X-22-69	XI-19-69	XII-18-69	IV-22-70	VI-17-70	VII-14-70	VIII-14-70	I-4-71	II-22-71
Solemya velum							9			
Nucula annulata	1									
Nucula delphinodonta										
Nucula proxima		1					1			
Yoldia limatula										
Anadara ovalis										
Anadara transversa								5		
Mytilus edulis										
Aequipecten irradians								5		1
Anomia simplex						2	3	42	1	
Astarte borealis										
Crassinella mactracea							1			
Rochefortia cuneata		1		1				2		
Cerastoderma pinnulatum						78	29	6		
Laevicardium mortoni	1	3						38	3	
Gemma gemma							2			
Mercenaria mercenaria					NONE					
Pitar morrhuana					ALIVE			2		
Petricola pholadiformis								10		
Mulinia lateralis							1	2		
Macoma balthica										
Macoma tenta								112		
Tellina agilis	1							8		
Cumingia tellinoides										
Tagelus divisus								58	1	15
Ensis directus							4			
Mya arenaria										
Corbula contracta										
Corbula swiftiana										
Pandora gouldiana		2	2	1		1	1	15	2	
Lyonsia hyalina				1		1	1	30	1	
Pelecypod sp. B								9		
Pelecypod sp. C				2						
Pelecypod larvae							3		6	
Pelecypod #5										
TOTAL INDIVIDUALS	3	7	2	5	0	82	55	344	14	16
TOTAL SPECIES	3	4	1	4	0	4	11	15	6	2

STATION– 7 BIVALVES SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-23-69	X-14-69	XI-13-69	XII-17-69	XII-17-69					
Solemya velum										
Nucula annulata										
Nucula delphinodonta										
Nucula proxima										
Yoldia limatula										
Anadara ovalis										
Anadara transversa										
Mytilus edulis										
Aequipecten irradians										
Anomia simplex										
Astarte borealis										
Crassinella mactracea										
Rochefortia cuneata										
Cerastoderma pinnulatum										
Laevicardium mortoni				1						
Gemma gemma										
Mercenaria mercenaria	NONE	NONE	NONE							
Pitar morrhuana	ALIVE	ALIVE	ALIVE							
Petricola pholadiformis										
Mulinia lateralis										
Macoma balthica										
Macoma tenta										
Tellina agilis										
Cumingia tellinoides										
Tagelus divisus										
Ensis directus										
Mya arenaria										
Corbula contracta										
Corbula swiftiana										
Pandora gouldiana					1					
Lyonsia hyalina				8						
Pelecypod sp. B										
Pelecypod sp. C										
Pelecypod larvae										
Pelecypod #5										
TOTAL INDIVIDUALS	0	0	0	9	1					
TOTAL SPECIES	0	0	0	2	1					

STATION–8 BIVALVES SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES		IX-27-69	X-22-69			
Solemya velum						
Nucula annulata						
Nucula delphinodonta						
Nucula proxima			11			
Yoldia limatula						
Anadara ovalis						
Anadara transversa						
Mytilus edulis						
Aequipecten irradians						
Anomia simplex						
Astarte borealis						
Crassinella mactracea		3				
Rochefortia cuneata						
Cerastoderma pinnulatum						
Laevicardium mortoni						
Gemma gemma						
Mercenaria mercenaria						
Pitar morrhuana						
Petricola pholadiformis						
Mulinia lateralis						
Macoma balthica						
Macoma tenta						
Tellina agilis						
Cumingia tellinoides						
Tagelus divisus						
Ensis directus						
Mya arenaria						
Corbula contracta						
Corbula swiftiana						
Pandora gouldiana						
Lyonsia hyalina						
Pelecypod sp. B						
Pelecypod sp. C						
Pelecypod larvae						
Pelecypod #5						
TOTAL INDIVIDUALS		3	11			
TOTAL SPECIES		1	1			

STATION—9

BIVALVES SAMPLE SIZE $^{1}/_{25}$ M^2

SPECIES	IX-24-69	X-14-69	XI-17-69	XII-18-69	IV-8-70	V-15-70	XII-6-70	VII-13-70	VIII-11-70	IX-29-70	XI-12-70	XII-22-70	II-19-71	IV-26-71	VI-9-71	VIII-24-71	XII-29-71	III-23-72			
Solemya velum									1		1		2		4	5					
Nucula annulata	2					5	2	2	2	1		2	1			2		5			
Nucula delphinodonta																					
Nucula proxima																					
Yoldia limatula						2	10	2	4								5	3			
Anadara ovalis																1					
Anadara transversa									12	1		1	2	1		1	1				
Mytilus edulis																					
Aequipecten irradians																	1				
Anomia simplex																					
Astarte borealis																					
Crassinella mactracea																					
Rochefortia cuneata		1	1														12				
Cerastoderma pinnulatum							7	5	5			1				3					
Laevicardium mortoni									6	1	2		2	2			1				
Gemma gemma																					
Mercenaria mercenaria					NONE ALIVE				4												
Pitar morrhuana		3	1	1						8	2	1					13	21			
Petricola pholadiformis	1	1							6	2	1	1				1					
Mulinia lateralis							7	7	256	31	25	7	2	1		1					
Macoma balthica																					
Macoma tenta				1					2262	112	48	58	1	7	1	19	5				
Tellina agilis							1		11	4	5		5		2	3	1	27			
Cumingia tellinoides																					
Tagelus divisus									22	6	24	5			2	2					
Ensis directus							7	3	2						1						
Mya arenaria																					
Corbula contracta																					
Corbula swiftiana																					
Pandora gouldiana									1	1						3	8	5			
Lyonsia hyalina									6			1		1	1	2					
Pelecypod sp. B									14		1										
Pelecypod sp. C																					
Pelecypod larvae									1												
Pelecypod #5										7		1	1								
TOTAL INDIVIDUALS	3	5	2	2	0	7	34	19	2615	174	109	78	16	12	11	43	47	61			
TOTAL SPECIES	2	3	2	2	0	2	6	5	17	11	9	10	8	5	6	12	9	5			

STATION—10   BIVALVES   SAMPLE SIZE $^1/_{25}$ M^2

SPECIES	IX-22-69	X-14-69	XI-17-69	XII-18-69	IV-6-70	V-10-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71	VI-10-71	VIII-24-71	XII-29-71	XII-29-71	II-20-72	III-20-72		
Solemya velum														1		1					
Nucula annulata		6		4	3	2	1	6	23	4	2			3	1	8	5	3	7		
Nucula delphinodonta																					
Nucula proxima			1																		
Yoldia limatula	1						5	6	6					1		15	13	1	4		
Anadara ovalis											2							1			
Anadara transversa									3	4		2				54	10	8	3		
Mytilus edulis																					
Aequipecten irradians									3						1						
Anomia simplex																					
Astarte borealis									47												
Crassinella mactracea																					
Rochefortia cuneata	2				1				247	1			2			5	2		3		
Cerastoderma pinnulatum					4			13	13				1	13							
Laevicardium mortoni									30	13	1	1	1			3	4	1			
Gemma gemma																					
Mercenaria mercenaria																5	1				
Pitar morrhuana									19							17	6	3	5		
Petricola pholadiformis									42							7					
Mulinia lateralis								5	265	7	19	2	2	1		38	62				
Macoma balthica																					
Macoma tenta	1							19	2554	309	60	67	7		1	24	21	1	9		
Tellina agilis	1								65			4	8		1	15	32	7	10		
Cumingia tellinoides																			1		
Tagelus divisus									247	17	13	15	10		1		1				
Ensis directus							8	4	5					20							
Mya arenaria																					
Corbula contracta																					
Corbula swiftiana																					
Pandora gouldiana		1							24							3	1				
Lyonsia hyalina	1			1					49								1	1			
Pelecypod sp. B			1	2					12	23	3			1		1		3			
Pelecypod sp. C													2								
Pelecypod larvae																					
Pelecypod #5												1									
TOTAL INDIVIDUALS	6	7	2	7	8	2	14	53	3654	378	100	92	33	40	5	196	159	29	42		
TOTAL SPECIES	5	2	2	3	3	1	3	6	18	8	7	7	8	7	5	14	13	10	8		

STATION—20 BIVALVES SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-24-69	X-16-69	XI-13-69	XII-18-69	I-6-70	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71						
Solemya velum										1	1				2						
Nucula annulata																					
Nucula delphinodonta																					
Nucula proxima	2	2	2	3	3		3	2	1			1	8	3	3						
Yoldia limatula																					
Anadara ovalis																					
Anadara transversa																					
Mytilus edulis				1																	
Aequipecten irradians										4	1										
Anomia simplex	1										2										
Astarte borealis														1	1						
Crassinella mactracea												1	2								
Rochefortia cuneata		1								1	1	10	6	1							
Cerastoderma pinnulatum							1		20	23		8	6	3	2						
Laevicardium mortoni		1	2	1						3	23	8	4								
Gemma gemma																					
Mercenaria mercenaria																					
Pitar morrhuana			1	1							2										
Petricola pholadiformis										1				6							
Mulinia lateralis											1										
Macoma balthica																					
Macoma tenta									1	8	3			1	1						
Tellina agilis											5	2	5		2						
Cumingia tellinoides																					
Tagelus divisus											10		3		3						
Ensis directus				1						7											
Mya arenaria																					
Corbula contracta																					
Corbula swiftiana																					
Pandora gouldiana		3				2	1	2		1	2	7	3	9	3						
Lyonsia hyalina			1	5	13						7		6								
Pelecypod sp. B	1														3						
Pelecypod sp. C															1						
Pelecypod larvae																					
Pelecypod #5																					
TOTAL INDIVIDUALS	4	7	6	12	16	2	5	4	22	49	58	37	43	24	21						
TOTAL SPECIES	3	4	4	6	2	1	3	2	3	9	12	7	9	7	10						

STATION—28 BIVALVES SAMPLE SIZE 1/25 M²

SPECIES		IX-19*69	IX-27*69	I-6*70																	
Solemya velum																					
Nucula annulata																					
Nucula delphinodonta																					
Nucula proxima																					
Yoldia limatula																					
Anadara ovalis		1																			
Anadara transversa		7																			
Mytilus edulis																					
Aequipecten irradians																					
Anomia simplex																					
Astarte borealis																					
Crassinella mactracea																					
Rochefortia cuneata																					
Cerastoderma pinnulatum																					
Laevicardium mortoni																					
Gemma gemma																					
Mercenaria mercenaria																					
Pitar morrhuana			NONE	NONE																	
Petricola pholadiformis			ALIVE	ALIVE																	
Mulinia lateralis																					
Macoma balthica																					
Macoma tenta																					
Tellina agilis		7																			
Cumingia tellinoides																					
Tagelus divisus																					
Ensis directus																					
Mya arenaria		1																			
Corbula contracta																					
Corbula swiftiana																					
Pandora gouldiana																					
Lyonsia hyalina																					
Pelecypod sp. B																					
Pelecypod sp. C																					
Pelecypod larvae																					
Pelecypod #5																					
TOTAL INDIVIDUALS		16	0	0																	
TOTAL SPECIES		4	0	0																	

*TRAWL SAMPLES

STATION—30 **BIVALVES** **SAMPLE SIZE $\frac{1}{25}$ M^2**

SPECIES	IX-27-69	X-10-69	XI-17-69	XII-17-69	VI-17-70	IX-30-70	II-22-71				
Solemya velum							14				
Nucula annulata	1										
Nucula delphinodonta											
Nucula proxima						3	1				
Yoldia limatula											
Anadara ovalis							1				
Anadara transversa						3					
Mytilus edulis											
Aequipecten irradians											
Anomia simplex		2									
Astarte borealis											
Crassinella mactracea											
Rochefortia cuneata											
Cerastoderma pinnulatum					58		1				
Laevicardium mortoni	12	1				6					
Gemma gemma											
Mercenaria mercenaria			NONE								
Pitar morrhuana			ALIVE								
Petricola pholadiformis		2				16	2				
Mulinia lateralis					1						
Macoma balthica							1				
Macoma tenta						3	1				
Tellina agilis				2							
Cumingia tellinoides											
Tagelus divisus							18				
Ensis directus					15						
Mya arenaria											
Corbula contracta											
Corbula swiftiana							1				
Pandora gouldiana							4				
Lyonsia hyalina											
Pelecypod sp. B											
Pelecypod sp. C											
Pelecypod larvae											
Pelecypod #5						4					
TOTAL INDIVIDUALS	13	5	0	2	74	35	44				
TOTAL SPECIES	2	3	0	1	3	6	10				

STATION—37 **BIVALVES** **SAMPLE SIZE $\frac{1}{25}$ M^2**

SPECIES		XI-13-[illegible]				
Solemya velum						
Nucula annulata						
Nucula delphinodonta						
Nucula proxima						
Yoldia limatula						
Anadara ovalis						
Anadara transversa						
Mytilus edulis						
Aequipecten irradians						
Anomia simplex						
Astarte borealis						
Crassinella mactracea						
Rochefortia cuneata						
Cerastoderma pinnulatum						
Laevicardium mortoni						
Gemma gemma						
Mercenaria mercenaria						
Pitar morrhuana						
Petricola pholadiformis						
Mulinia lateralis						
Macoma balthica						
Macoma tenta		1				
Tellina agilis						
Cumingia tellinoides						
Tagelus divisus						
Ensis directus						
Mya arenaria						
Corbula contracta						
Corbula swiftiana						
Pandora gouldiana						
Lyonsia hyalina						
Pelecypod sp. B						
Pelecypod sp. C						
Pelecypod larvae						
Pelecypod #5						
TOTAL INDIVIDUALS		1				
TOTAL SPECIES		1				

STATION – 31

BIVALVES SAMPLE SIZE $\frac{1}{25}$ M^2 EXCEPT WHERE OTHERWISE NOTED

SPECIES	IX-19*-69	IX-26-69	X-24-69	XI-17-69	XII-22-69	II-3†-70	V-12-70	VI-12-70	VII-14-70	VIII-18-70	IX-29-70	XI-10-70	XII-22-70	I-13-71	VI-2-71	VII-9-71	VIII-24-71	XII-29-71	III-23-72	IX-8-72	I-18-73
Solemya velum																					
Nucula annulata																					
Nucula delphinodonta																					
Nucula proxima																					
Yoldia limatula																					
Anadara ovalis																					
Anadara transversa																					
Mytilus edulis																					
Aequipecten irradians	1																				
Anomia simplex										1											
Astarte borealis																					
Crassinella mactracea																					
Rochefortia cuneata																					
Cerastoderma pinnulatum																					
Laevicardium mortoni																					
Gemma gemma																					
Mercenaria mercenaria			NONE	NONE	NONE	NONE		NONE				NONE		NONE		NONE		NONE			NONE
Pitar morrhuana			ALIVE	ALIVE	ALIVE	ALIVE		ALIVE				ALIVE		ALIVE		ALIVE		ALIVE			ALIVE
Petricola pholadiformis										3											
Mulinia lateralis																					
Macoma balthica									4	1											
Macoma tenta																					
Tellina agilis										45	3						3		3	5	
Cumingia tellinoides																					
Tagelus divisus																					
Ensis directus																					
Mya arenaria													2								
Corbula contracta									1												
Corbula swiftiana																					
Pandora gouldiana																					
Lyonsia hyalina															2						
Pelecypod sp. B										7	1										
Pelecypod sp. C																					
Pelecypod larvae		1					1										1				
Pelecypod #5											1										
TOTAL INDIVIDUALS	1	1	0	0	0	0	1	0	5	57	5	0	2	0	2	0	4	0	3	5	0
TOTAL SPECIES	1	1	0	0	0	0	1	0	2	5	3	0	1	0	1	0	2	0	1	1	0

* TRAWL SAMPLE

† $\frac{1}{10}$ M^2 VAN VEEN GRAB SAMPLE

A(35)

STATION—35

BIVALVES SAMPLE SIZE 1/25 M²

SPECIES	X-16-69	XI-13-69	XII-18-69	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	I-4-71	II-19-71	VIII-25-71
Solemya velum														
Nucula annulata	5		2		4	2	3	8	6		3		1	
Nucula delphinodonta				3	1	2		2						13
Nucula proxima														3
Yoldia limatula													1	
Anadara ovalis												1		
Anadara transversa									6					1
Mytilus edulis														
Aequipecten irradians														
Anomia simplex									1					
Astarte borealis									8	7				
Crassinella mactracea														
Rochefortia cuneata									8					3
Cerastoderma pinnulatum	2		3				42	7	13	3	8	2	3	7
Laevicardium mortoni	1								3	6	4	3	3	12
Gemma gemma														
Mercenaria mercenaria														
Pitar morrhuana					1		1		13	7	3		1	
Petricola pholadiformis														
Mulinia lateralis										1				
Macoma balthica										1				
Macoma tenta		1							22	2	1	2	2	15
Tellina agilis						1			7		2		1	2
Cumingia tellinoides														
Tagelus divisus														
Ensis directus								1						
Mya arenaria														
Corbula contracta												1		
Corbula swiftiana														
Pandora gouldiana											2		1	
Lyonsia hyalina			6	2	1			1	15				7	2
Pelecypod sp. B														
Pelecypod sp. C														
Pelecypod larvae														
Pelecypod #5														
TOTAL INDIVIDUALS	8	1	11	5	7	5	46	19	89	27	23	9	20	58
TOTAL SPECIES	3	1	3	2	4	3	3	5	10	7	7	5	9	9

STATION-80 BIVALVES SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	VIII-12-70	XI-18-70	VI-10-71					
Solemya velum			1					
Nucula annulata								
Nucula delphinodonta								
Nucula proxima								
Yoldia limatula		1						
Anadara ovalis								
Anadara transversa		1						
Mytilus edulis								
Aequipecten irradians								
Anomia simplex								
Astarte borealis								
Crassinella mactracea		3	17					
Rochefortia cuneata								
Cerastoderma pinnulatum	7		42					
Laevicardium mortoni								
Gemma gemma								
Mercenaria mercenaria								
Pitar morrhuana		1						
Petricola pholadiformis								
Mulinia lateralis								
Macoma balthica								
Macoma tenta	1	7						
Tellina agilis		11	5					
Cumingia tellinoides								
Tagelus divisus								
Ensis directus								
Mya arenaria								
Corbula contracta								
Corbula swiftiana								
Pandora gouldiana	1	1						
Lyonsia hyalina		22						
Pelecypod sp. B		1						
Pelecypod sp. C		5						
Pelecypod larvae								
Pelecypod #5								
TOTAL INDIVIDUALS	9	53	65					
TOTAL SPECIES	3	10	4					

STATION-90 BIVALVES SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	VIII-14-70	XI-18-70	I-4-71	II-22-71	IV-26-71	VI-10-71	VII-2-71	VIII-26-71
Solemya velum								
Nucula annulata	9	91	17	5	95	18	109	43
Nucula delphinodonta						1		
Nucula proxima						2		
Yoldia limatula	9	6	4	1	3	9	13	1
Anadara ovalis								
Anadara transversa								
Mytilus edulis								
Aequipecten irradians								
Anomia simplex								
Astarte borealis								
Crassinella mactracea								
Rochefortia cuneata	2	16		1	3	12		2
Cerastoderma pinnulatum					1	1		
Laevicardium mortoni								
Gemma gemma								
Mercenaria mercenaria	7							
Pitar morrhuana	2	3	1	16	1	10		
Petricola pholadiformis	6							
Mulinia lateralis	43	2	8		5		1	1
Macoma balthica								
Macoma tenta	1228	684	386	214	188	50	35	132
Tellina agilis	4	8	4		2	7		15
Cumingia tellinoides								
Tagelus divisus	5							
Ensis directus								
Mya arenaria								
Corbula contracta								
Corbula swiftiana						3		
Pandora gouldiana		2						
Lyonsia hyalina	2							
Pelecypod sp. B			1					
Pelecypod sp. C								
Pelecypod larvae								
Pelecypod #5								
TOTAL INDIVIDUALS	1317	812	421	237	298	113	158	194
TOTAL SPECIES	11	8	7	5	8	10	4	6

BIVALVES SAMPLE SIZE $\frac{1}{128}$ M^2

STATIONS SIPPEWISSETT MARSH

SPECIES		SIPP 3		SIPP 4		SIPP 7		SIPP 8	
		II-24-70		IX-24-70		VIII-6-70		XII-13-70	I-11-71
Solemya velum									
Nucula annulata									
Nucula delphinodonta									
Nucula proxima									
Yoldia limatula									
Anadara ovalis									
Anadara transversa									
Mytilus edulis									
Aequipecten irradians									
Anomia simplex									
Astarte borealis									
Crassinella mactracea									
Rochefortia cuneata									
Cerastoderma pinnulatum									
Laevicardium mortoni									
Gemma gemma		6		8				25	109
Mercenaria mercenaria									
Pitar morrhuana									
Petricola pholadiformis									
Mulinia lateralis									
Macoma balthica									
Macoma tenta									
Tellina agilis									2
Cumingia tellinoides									
Tagelus divisus									
Ensis directus									
Mya arenaria				1		14		9	1
Corbula contracta									
Corbula swiftiana									
Pandora gouldiana									
Lyonsia hyalina									
Pelecypod sp. B									
Pelecypod sp. C									
Pelecypod larvae									
Pelecypod #5									
TOTAL INDIVIDUALS		6		9		14		34	112
TOTAL SPECIES		1		2		1		2	3

STATION–II GASTROPODS SAMPLE SIZE $\frac{1}{128}$ M^2

SPECIES	IX-19-69	IX-26-69	XII-7-69	II-24-70	III-31-70	VI-16-70	VIII-3-70	VIII-3-70	X-1-70	I-11-71	III-1-71	X-6-71
Melanella sp.												
Epitonium sp.												
Littorina littorea												
Hydrobia totteni	188	19	31	3		2	5	32	19	12	9	151
Caecum cooperi												
Caecum pulchellum												
Caecum sp.												
Bittium alternatum												
Cerithiopsis sp.												
Crepidula fornicata												
Crepidula plana												
Crepidula juv.												
Natica pusilla												
Polinices duplicatus												
Eupleura caudata												
Urosalpinx cinerea												
Busycon canaliculatum												
Busycon carica												
Anachis translirata												
Mitrella lunata												
Nassarius obsoletus					NONE							
Nassarius trivittatus					ALIVE							
Kurtziella cerina												
Haminoea solitaria							2	13	3			
Retusa canaliculata												5
Philine sp.												
Odostomia bisuturalis												
Odostomia dux												
Odostomia gibbosa												
Odostomia katherinae												
Odostomia bartschi												
Odostomia sumneri												
Odostomia winkleyi												
Sayella fusca												
Sayella producta												
Turbonilla elegantula												
Turbonilla interrupta												
Turbonilla nivea												
Cylichna occulta												
Cylichna oryza												
Rictaxis punctostriatus												1
Gastropod sp.												1
TOTAL INDIVIDUALS	188	19	31	3	0	2	7	45	22	12	9	158
TOTAL SPECIES	1	1	1	1	0	1	2	2	2	1	1	4

STATION—IV GASTROPODS SAMPLE SIZE $^{1}/_{128}$ M^2

SPECIES	IX-21-69	X-9*-69	XII-7-69	II-22-70	IV-19-70	V-20-70	VI-15-70	VII-14-70	VIII-6-70	X-2-70	X-2-70	XI-11-70	XII-8-70	III-1-71	IX-26-71	VI-4-71	XII-8-71	VIII-9-71	IX-17-71	IX-13-72	V-26-72
Melanella sp.																					
Epitonium sp.																					
Littorina littorea												1									
Hydrobia totteni	2						1		15	5	12	42	7	22	10	28	139	182	17	9	16
Caecum cooperi																					
Caecum pulchellum																					
Caecum sp.																					
Bittium alternatum	1									2	15		1								
Cerithiopsis sp.																					
Crepidula fornicata										1											
Crepidula plana																					
Crepidula juv.																					
Natica pusilla																					
Polinices duplicatus																					
Eupleura caudata																					
Urosalpinx cinerea																					
Busycon canaliculatum																					
Busycon carica																					
Anachis translirata																					
Mitrella lunata											1										
Nassarius obsoletus	1	NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE		NONE ALIVE												1	
Nassarius trivittatus																					
Kurtziella cerina																					
Haminoea solitaria	9								9	3	7	1	2				4	6	5		
Retusa canaliculata																					
Philine sp.																					
Odostomia bisuturalis																					
Odostomia dux																					
Odostomia gibbosa																					
Odostomia katherinae																		1			
Odostomia bartschi																					
Odostomia sumneri																					
Odostomia winkleyi												7	3	9					13		
Sayella fusca																		1	1		
Sayella producta																					
Turbonilla elegantula																					
Turbonilla interrupta																					
Turbonilla nivea																					
Cylichna occulta																					
Cylichna oryza																					
Rictaxis punctostriatus																					
Gastropod sp.																					
TOTAL INDIVIDUALS	13	0	0	0	0	0	1	0	24	11	35	51	13	31	10	28	143	190	36	10	16
TOTAL SPECIES	4	0	0	0	0	0	1	0	2	4	4	4	4	2	1	1	2	4	4	2	1

*12" x 12" SAMPLE PUT THROUGH 0.297 MM SCREEN

STATION–5 **GASTROPODS** **SAMPLE SIZE** $\frac{1}{25}$ **M^2**

SPECIES	IX-27-69	X-22-69	XI-19-69	XII-18-69	IV-22-70	VI-17-70	VII-14-70	VIII-14-70	I-4-71	VII-22-71											
Melanella sp.			1																		
Epitonium sp.																					
Littorina littorea																					
Hydrobia totteni																					
Caecum cooperi	1	5	2	28	13	6	13	9	38												
Caecum pulchellum			2					1		1											
Caecum sp.																					
Bittium alternatum	3							12													
Cerithiopsis sp.																					
Crepidula fornicata																					
Crepidula plana	9	1				1		33	4	1											
Crepidula juv.																					
Natica pusilla	6	9	1	4	5		1	20	7	9											
Polinices duplicatus																					
Eupleura caudata																					
Urosalpinx cinerea									1	1											
Busycon canaliculatum																					
Busycon carica																					
Anachis translirata										1											
Mitrella lunata	7		1			1		35	1	12											
Nassarius obsoletus																					
Nassarius trivittatus	1			1																	
Kurtziella cerina																					
Haminoea solitaria																					
Retusa canaliculata								4		3											
Philine sp.	3		5	1				22		1											
Odostomia bisuturalis																					
Odostomia dux																					
Odostomia gibbosa																					
Odostomia katherinae																					
Odostomia bartschi								8													
Odostomia sumneri	5	1	4	3	1			20	7	20											
Odostomia winkleyi				1		1		32	10	65											
Sayella fusca									1												
Sayella producta																					
Turbonilla elegantula										44											
Turbonilla interrupta					1																
Turbonilla nivea				1				6													
Cylichna occulta																					
Cylichna oryza								107		13											
Rictaxis punctostriatus	2									2											
Gastropod sp.																					
TOTAL INDIVIDUALS	37	16	16	39	20	9	14	309	69	173											
TOTAL SPECIES	9	4	7	7	4	4	2	13	8	13											

STATION–7 **GASTROPODS SAMPLE SIZE $1/25$ M^2**

SPECIES	IX-23-69	X-14-69	XI-13-69	XII-17-69	XII-17-69					
Melanella sp.										
Epitonium sp.										
Littorina littorea										
Hydrobia totteni										
Caecum cooperi										
Caecum pulchellum	1									
Caecum sp.										
Bittium alternatum				2						
Cerithiopsis sp.										
Crepidula fornicata										
Crepidula plana	1		1	10						
Crepidula juv.										
Natica pusilla	2	3		3						
Polinices duplicatus										
Eupleura caudata										
Urosalpinx cinerea										
Busycon canaliculatum										
Busycon carica										
Anachis translirata					1					
Mitrella lunata	2				7					
Nassarius obsoletus										
Nassarius trivittatus		1								
Kurtziella cerina										
Haminoea solitaria										
Retusa canaliculata										
Philine sp.										
Odostomia bisuturalis										
Odostomia dux										
Odostomia gibbosa										
Odostomia katherinae										
Odostomia bartschi										
Odostomia sumneri										
Odostomia winkleyi										
Sayella fusca										
Sayella producta										
Turbonilla elegantula										
Turbonilla interrupta	3			6						
Turbonilla nivea										
Cylichna occulta										
Cylichna oryza			1							
Rictaxis punctostriatus										
Gastropod sp.										
TOTAL INDIVIDUALS	9	4	2	21	8					
TOTAL SPECIES	5	2	2	4	2					

STATION–8 **GASTROPODS SAMPLE SIZE $1/25$ M^2**

SPECIES		IX-27-69	X-22-69			
Melanella sp.						
Epitonium sp.						
Littorina littorea						
Hydrobia totteni						
Caecum cooperi						
Caecum pulchellum		23	16			
Caecum sp.						
Bittium alternatum		20				
Cerithiopsis sp.						
Crepidula fornicata						
Crepidula plana		7				
Crepidula juv.						
Natica pusilla		3	1			
Polinices duplicatus						
Eupleura caudata						
Urosalpinx cinerea						
Busycon canaliculatum						
Busycon carica						
Anachis translirata			2			
Mitrella lunata		19				
Nassarius obsoletus						
Nassarius trivittatus						
Kurtziella cerina						
Haminoea solitaria						
Retusa canaliculata						
Philine sp.			13			
Odostomia bisuturalis						
Odostomia dux						
Odostomia gibbosa						
Odostomia katherinae						
Odostomia bartschi						
Odostomia sumneri						
Odostomia winkleyi						
Sayella fusca						
Sayella producta						
Turbonilla elegantula						
Turbonilla interrupta		1				
Turbonilla nivea						
Cylichna occulta						
Cylichna oryza						
Rictaxis punctostriatus						
Gastropod sp.						
TOTAL INDIVIDUALS		73	32			
TOTAL SPECIES		6	4			

STATION—9 GASTROPODS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-24-69	X-14-69	XI-17-69	XII-18-69	IV-8-70	V-15-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-12-70	XII-22-70	II-19-71	IV-26-71	VI-9-71	VIII-24-71	XII-29-71	IX-23-72			
Melanella sp.																					
Epitonium sp.									1												
Littorina littorea																					
Hydrobia totteni																					
Caecum cooperi																					
Caecum pulchellum				1						1	2		2								
Caecum sp.		2																			
Bittium alternatum									14		1			1							
Cerithiopsis sp.																					
Crepidula fornicata									7	1	1										
Crepidula plana	5							2		1											
Crepidula juv.																					
Natica pusilla	4	3		1					4	6	9	7	3			7	2	1			
Polinices duplicatus																					
Eupleura caudata																1					
Urosalpinx cinerea																					
Busycon canaliculatum										1											
Busycon carica																					
Anachis translirata																					
Mitrella lunata	1	1						1	6	10	15		6	5		2					
Nassarius obsoletus																					
Nassarius trivittatus	1	1				1				6	4	2	2	1	1	7		2			
Kurtziella cerina											1										
Haminoea solitaria																					
Retusa canaliculata			2	2					19	39	12	21	9	37							
Philine sp.	2		1	1		3			5	6	4	3	4			5		2			
Odostomia bisuturalis																					
Odostomia dux																2					
Odostomia gibbosa																					
Odostomia katherinae																					
Odostomia bartschi																					
Odostomia sumneri	25	18	18	22	1		1		5	9	16	36	20	6		2	10	1			
Odostomia winkleyi	1	2		1					3	54	112	71	63	69	31	1	4	2			
Sayella fusca																		1			
Sayella producta																					
Turbonilla elegantula																					
Turbonilla interrupta		1					1										1	1			
Turbonilla nivea				2								1	2								
Cylichna occulta																					
Cylichna oryza	26	32	22	56	7	8	6	2	26	225	51	19	26	1		12	158	4			
Rictaxis punctostriatus	3									2				1		1	1				
Gastropod sp.																					
TOTAL INDIVIDUALS	68	60	43	86	8	12	8	5	90	361	228	160	137	121	32	40	176	14			
TOTAL SPECIES	9	8	4	8	2	3	3	3	10	13	12	8	10	8	2	10	6	8			

STATION— 10 GASTROPODS SAMPLE SIZE $^{1}/_{25}$ M^2

SPECIES	IX-22-69	X-14-69	XI-17-69	XII-18-69	IX-6-70	V-10-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71	VI-10-71	VIII-24-71	XII-29-71	XII-29-71	III-23-72	III-23-72		
Melanella sp.																					
Epitonium sp.									1												
Littorina littorea																					
Hydrobia totteni																			4		
Caecum cooperi																					
Caecum pulchellum								1	2	2			1	1			2	9			
Caecum sp.																					
Bittium alternatum					1				1				3					3			
Cerithiopsis sp.		1																			
Crepidula fornicata								1	1							31	1	1			
Crepidula plana	5			2				1	2				1	3			10	10			
Crepidula juv.											1		1								
Natica pusilla	2	8	1	4			1		4	8	6	10	11	3		4					
Polinices duplicatus													1								
Eupleura caudata																	1				
Urosalpinx cinerea		1							1		1										
Busycon canaliculatum																					
Busycon carica																					
Anachis translirata													1								
Mitrella lunata		1					1		14	35	17	53	7		9	22		7	6		
Nassarius obsoletus																					
Nassarius trivittatus		2					1				2	1		1	1	3	1				
Kurtziella cerina																					
Haminoea solitaria																	1				
Retusa canaliculata									101	45	5	14	12	20	1	7	9	2	7		
Philine sp.	6	2	1		1		1	2		8	4	3	1			15	7	32	18		
Odostomia bisuturalis																					
Odostomia dux																11					
Odostomia gibbosa																					
Odostomia katherinae																					
Odostomia bartschi									2							1					
Odostomia sumneri	6	19	14	20	2				25	27	11	13	25			5					
Odostomia winkleyi								1	46	88	89	103	67	94		11	6	4			
Sayella fusca																	1				
Sayella producta																					
Turbonilla elegantula						3						13									
Turbonilla interrupta	4	4	1	3	3		3	19		6		14	1	1			3				
Turbonilla nivea	1		1	4		1		1	3												
Cylichna occulta																	17				
Cylichna oryza	8	15	64	88	46	16	32	3	565	184	45	7	5			76	140	1	7		
Rictaxis punctostriatus			3						2					1		2	2				
Gastropod sp.																					
TOTAL INDIVIDUALS	32	53	85	121	53	20	39	29	770	403	181	231	137	124	11	188	201	69	42		
TOTAL SPECIES	7	9	7	6	5	3	6	8	15	9	10	10	14	8	3	12	14	9	5		

STATION—20 GASTROPODS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-24-69	X-16-69	XI-13-69	XII-18-69	I-6-70	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII22-70	II-19-71
Melanella sp.		1			1			1						1	
Epitonium sp.					1										
Littorina littorea															
Hydrobia totteni															
Caecum cooperi		11	17	11	21	4	2	1	4	2	10	22	62	11	26
Caecum pulchellum	2										1				6
Caecum sp.															
Bittium alternatum					1								15		
Cerithiopsis sp.															
Crepidula fornicata															
Crepidula plana						1	1			1	5		2		
Crepidula juv.															
Natica pusilla	6	13	3	7	5	5				1	15	12	3	8	2
Polinices duplicatus															
Eupleura caudata															
Urosalpinx cinerea															
Busycon canaliculatum															
Busycon carica										1					
Anachis translirata	2						2						1		
Mitrella lunata						3	4				2				2
Nassarius obsoletus															
Nassarius trivittatus		1					1	1	1	1	3				
Kurtziella cerina															
Haminoea solitaria															
Retusa canaliculata											1				
Philine sp.	1	8	11	2	27	3	1			1	21	12	15	4	
Odostomia bisuturalis															
Odostomia dux					1										
Odostomia gibbosa															
Odostomia katherinae															
Odostomia bartschi						1					1				
Odostomia sumneri				10	4	1						9			6
Odostomia winkleyi					4		1	1			2	3	18	5	7
Sayella fusca													2		
Sayella producta															
Turbonilla elegantula													3		
Turbonilla interrupta		2				13	3	6		1	14	4		13	11
Turbonilla nivea		1	2		6							7	1	8	
Cylichna occulta															
Cylichna oryza											14	14	1		
Rictaxis punctostriatus												1		2	
Gastropod sp.															
TOTAL INDIVIDUALS	11	37	33	30	71	31	15	10	5	8	89	84	123	52	60
TOTAL SPECIES	4	7	4	4	10	8	8	5	2	7	12	9	11	8	7

STATION — 28

GASTROPODS ALL TRAWL SAMPLES

SPECIES	IX-19*69	IX-27*69	I-6*70
Melanella sp.	1	1	
Epitonium sp.			
Littorina littorea			
Hydrobia totteni			
Caecum cooperi			
Caecum pulchellum	1		1
Caecum sp.			
Bittium alternatum	1025	1024	
Cerithiopsis sp.			
Crepidula fornicata	2		1
Crepidula plana	8	42	16
Crepidula juv.			
Natica pusilla			
Polinices duplicatus			
Eupleura caudata			
Urosalpinx cinerea			
Busycon canaliculatum			
Busycon carica			
Anachis translirata			
Mitrella lunata	11	9	8
Nassarius obsoletus			
Nassarius trivittatus			
Kurtziella cerina			
Haminoea solitaria			
Retusa canaliculata			
Philine sp.	2		
Odostomia bisuturalis	1		
Odostomia dux			
Odostomia gibbosa			
Odostomia katherinae			
Odostomia bartschi			
Odostomia sumneri			
Odostomia winkleyi			
Sayella fusca			
Sayella producta			
Turbonilla elegantula			
Turbonilla interrupta			
Turbonilla nivea			
Cylichna occulta			
Cylichna oryza			
Rictaxis punctostriatus			
Gastropod sp.			
TOTAL INDIVIDUALS	1051	1076	26
TOTAL SPECIES	8	4	4

*TRAWL SAMPLES

STATION–30 GASTROPODS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-27-69	X-10-69	XI-17-69	XII-17-69	VI-17-70	IX-30-70	II-22-71			
Melanella sp.										
Epitonium sp.										
Littorina littorea										
Hydrobia totteni										
Caecum cooperi		1		1			2			
Caecum pulchellum				2		7				
Caecum sp.										
Bittium alternatum		3		1		1130	14			
Cerithiopsis sp.										
Crepidula fornicata					1	1				
Crepidula plana		6	1		2	6				
Crepidula juv.					2					
Natica pusilla	1					7	7			
Polinices duplicatus										
Eupleura caudata						3	1			
Urosalpinx cinerea										
Busycon canaliculatum										
Busycon carica										
Anachis translirata										
Mitrella lunata		6				138	1			
Nassarius obsoletus										
Nassarius trivittatus						1				
Kurtziella cerina										
Haminoea solitaria										
Retusa canaliculata						6				
Philine sp.		8			2	6	1			
Odostomia bisuturalis						3				
Odostomia dux						6				
Odostomia gibbosa										
Odostomia katherinae										
Odostomia bartschi										
Odostomia sumneri		1								
Odostomia winkleyi						30	1			
Sayella fusca										
Sayella producta										
Turbonilla elegantula										
Turbonilla interrupta						2				
Turbonilla nivea						1				
Cylichna occulta										
Cylichna oryza				2		6				
Rictaxis punctostriatus										
Gastropod sp.										
TOTAL INDIVIDUALS	1	25	1	6	7	1353	27			
TOTAL SPECIES	1	6	1	4	4	16	7			

STATION–37 GASTROPODS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES		XI-13-69				
Melanella sp.						
Epitonium sp.						
Littorina littorea						
Hydrobia totteni						
Caecum cooperi						
Caecum pulchellum						
Caecum sp.						
Bittium alternatum						
Cerithiopsis sp.						
Crepidula fornicata						
Crepidula plana						
Crepidula juv.						
Natica pusilla		4				
Polinices duplicatus						
Eupleura caudata						
Urosalpinx cinerea						
Busycon canaliculatum						
Busycon carica						
Anachis translirata						
Mitrella lunata						
Nassarius obsoletus						
Nassarius trivittatus		1				
Kurtziella cerina						
Haminoea solitaria						
Retusa canaliculata						
Philine sp.		6				
Odostomia bisuturalis						
Odostomia dux						
Odostomia gibbosa						
Odostomia katherinae						
Odostomia bartschi						
Odostomia sumneri		25				
Odostomia winkleyi						
Sayella fusca						
Sayella producta						
Turbonilla elegantula						
Turbonilla interrupta						
Turbonilla nivea						
Cylichna occulta						
Cylichna oryza						
Rictaxis punctostriatus		1				
Gastropod sp.						
TOTAL INDIVIDUALS		37				
TOTAL SPECIES		5				

STATION—31 GASTROPODS SAMPLE SIZE 1/25 M² EXCEPT WHERE OTHERWISE NOTED

SPECIES	IX-19*-69	IX-25-69	X-24-69	XI-17-69	XII-22-69	III-3‡-70	V-12-70	VI-12-70	VII-14-70	VIII-18-70	IX-29-70	XI-10-70	XII-22-70	I-13-71	III-2-71	VI-9-71	VIII-24-71	IX-29-71	III-23-72	IX-5-72	I-19-73
Melanella sp.																					
Epitonium sp.																					
Littorina littorea	6																				
Hydrobia totteni													6				6		14		
Caecum cooperi															27						
Caecum pulchellum															6						
Caecum sp.																					
Bittium alternatum		7								65	1333	69	37	514	1485	2	540		53		
Cerithiopsis sp.																					
Crepidula fornicata	5																				
Crepidula plana	6																				
Crepidula juv.								1													
Natica pusilla	1																				
Polinices duplicatus																					
Eupleura caudata																					
Urosalpinx cinerea																					
Busycon canaliculatum																					
Busycon carica																					
Anachis translirata	6																2				
Mitrella lunata	157									11	36	5		40	11	2	50		6		
Nassarius obsoletus				NONE ALIVE		NONE ALIVE															
Nassarius trivittatus																					
Kurtziella cerina																					
Haminoea solitaria			1		2		13	7	5	151	18	135	90	19	1	11	1		112	48	3
Retusa canaliculata										2										7	
Philine sp.										13									4		
Odostomia bisuturalis	10	11									207	7	1	27	307	4	16				
Odostomia dux																					
Odostomia gibbosa																					
Odostomia katherinae																					
Odostomia bartschi																					
Odostomia sumneri																					
Odostomia winkleyi										8								3			
Sayella fusca	1	2								18	23	17		8	17	1	2		1		
Sayella producta													9	5	4						
Turbonilla elegantula																					
Turbonilla interrupta																					
Turbonilla nivea																					
Cylichna occulta																					
Cylichna oryza																					
Rictaxis punctostriatus																			1		
Gastropod sp.		6																			
TOTAL INDIVIDUALS	194	26	1	0	2	0	13	8	5	267	1617	233	143	613	1858	20	617	3	191	55	3
TOTAL SPECIES	8	4	1	0	1	0	1	2	1	7	5	5	5	6	8	5	7	1	7	2	1

*TRAWL SAMPLE

‡1/10 M² VAN VEEN GRAB SAMPLE

STATION—35 GASTROPODS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	X-16-69	XI-13-69	XII-16-69	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	I-4-71	IX-19-71	VIII-23-71							
Melanella sp.				1									1								
Epitonium sp.																					
Littorina littorea																					
Hydrobia totteni																					
Caecum cooperi																					
Caecum pulchellum																					
Caecum sp.																					
Bittium alternatum										3	1										
Cerithiopsis sp.																					
Crepidula fornicata																					
Crepidula plana									3												
Crepidula juv.							1														
Natica pusilla	8	4	12	7	4	1			2	2	2	2	7	1							
Polinices duplicatus																					
Eupleura caudata												1									
Urosalpinx cinerea					1																
Busycon canaliculatum																					
Busycon carica																					
Anachis translirata					1									2							
Mitrella lunata	5			2	11		1		8		1	18	10	163							
Nassarius obsoletus																					
Nassarius trivittatus			1			2	1	4	2	1			2								
Kurtziella cerina																					
Haminoea solitaria																					
Retusa canaliculata																					
Philine sp.		3	2	2	3	1	1		2	12	10	1		19							
Odostomia bisuturalis																					
Odostomia dux																					
Odostomia gibbosa																					
Odostomia katherinae																					
Odostomia bartschi									1		6	1	2								
Odostomia sumneri														1							
Odostomia winkleyi							1		1	14	16	10	11	6							
Sayella fusca									3	3											
Sayella producta																					
Turbonilla elegantula																					
Turbonilla interrupta	4	8	7	2	1	6	5	1		13	17	6	30	2							
Turbonilla nivea						1	2				1		8								
Cylichna occulta																					
Cylichna oryza									1	37	5	2									
Rictaxis punctostriatus				1						1											
Gastropod sp.											1										
TOTAL INDIVIDUALS	17	15	22	15	21	11	12	5	23	86	60	41	71	194							
TOTAL SPECIES	3	3	4	6	6	5	7	2	9	9	10	8	8	7							

STATION—80 GASTROPODS SAMPLE SIZE $^1/_{25}$ M^2

SPECIES	VI-12-70	XI-18-70	VI-10-71							
Melanella sp.			1							
Epitonium sp.										
Littorina littorea										
Hydrobia totteni		5								
Caecum cooperi		3	34							
Caecum pulchellum			37							
Caecum sp.										
Bittium alternatum		1								
Cerithiopsis sp.										
Crepidula fornicata										
Crepidula plana	2	13								
Crepidula juv.										
Natica pusilla	1									
Polinices duplicatus										
Eupleura caudata										
Urosalpinx cinerea										
Busycon canaliculatum										
Busycon carica										
Anachis translirata		5								
Mitrella lunata	1									
Nassarius obsoletus										
Nassarius trivittatus										
Kurtziella cerina										
Haminoea solitaria										
Retusa canaliculata										
Philine sp.	2	10								
Odostomia bisuturalis										
Odostomia dux										
Odostomia gibbosa										
Odostomia katherinae										
Odostomia bartschi										
Odostomia sumneri	2	6	3							
Odostomia winkleyi			7							
Sayella fusca										
Sayella producta										
Turbonilla elegantula										
Turbonilla interrupta	1									
Turbonilla nivea										
Cylichna occulta										
Cylichna oryza										
Rictaxis punctostriatus										
Gastropod sp.										
TOTAL INDIVIDUALS	9	43	82							
TOTAL SPECIES	6	7	5							

STATION—90 GASTROPODS SAMPLE SIZE $^1/_{25}$ M^2

SPECIES	VIII-14-70	XI-18-70	I-4-71	II-22-71	IV-26-71	XI-10-71	XII-2-71	VIII-26-71
Melanella sp.								
Epitonium sp.								
Littorina littorea								
Hydrobia totteni			6					
Caecum cooperi								
Caecum pulchellum							1	
Caecum sp.								
Bittium alternatum	1							
Cerithiopsis sp.								
Crepidula fornicata								
Crepidula plana								
Crepidula juv.								
Natica pusilla	2	2	1	1	2		1	1
Polinices duplicatus		1						
Eupleura caudata			1	1		1		
Urosalpinx cinerea								
Busycon canaliculatum								
Busycon carica								
Anachis translirata								
Mitrella lunata	15	2						
Nassarius obsoletus								
Nassarius trivittatus		2	6	1	2		3	3
Kurtziella cerina					1	1		
Haminoea solitaria								
Retusa canaliculata	48	23	31	16	28	6	12	3
Philine sp.	9		1	2				
Odostomia bisuturalis								
Odostomia dux								
Odostomia gibbosa								
Odostomia katherinae								
Odostomia bartschi			1					
Odostomia sumneri	10	18	29	23	3	3		1
Odostomia winkleyi		13	8	8	22	16	8	
Sayella fusca								
Sayella producta								
Turbonilla elegantula								
Turbonilla interrupta	20	4	85	114	35	7	101	12
Turbonilla nivea								
Cylichna occulta								
Cylichna oryza	41	10	23	9		5		
Rictaxis punctostriatus				3				
Gastropod sp.								
TOTAL INDIVIDUALS	146	75	192	178	93	39	126	20
TOTAL SPECIES	8	9	11	10	7	7	6	5

GASTROPODS SAMPLE SIZE $\frac{1}{128}$ M^2

STATIONS SIPPEWISSETT MARSH

SPECIES	SIPP 3	SIPP 4	SIPP 7	SIPP 8	
	II-24-70	II-24-70	VIII-6-70	VIII-13-70	X-11-71
Melanella sp.					
Epitonium sp.					
Littorina littorea			1	8	
Hydrobia totteni	80	65	20	204	39
Caecum cooperi					
Caecum pulchellum	1				
Caecum sp.					
Bittium alternatum				1	
Cerithiopsis sp.					
Crepidula fornicata					
Crepidula plana					
Crepidula juv.					
Natica pusilla					
Polinices duplicatus					
Eupleura caudata					
Urosalpinx cinerea					
Busycon canaliculatum					
Busycon carica					
Anachis translirata					
Mitrella lunata		1			
Nassarius obsoletus					
Nassarius trivittatus					
Kurtziella cerina					
Haminoea solitaria					
Retusa canaliculata					1
Philine sp.					
Odostomia bisuturalis		1			
Odostomia dux					
Odostomia gibbosa					
Odostomia katherinae					
Odostomia bartschi					
Odostomia sumneri					
Odostomia winkleyi					
Sayella fusca	2				
Sayella producta					
Turbonilla elegantula					
Turbonilla interrupta					
Turbonilla nivea					
Cylichna occulta					
Cylichna oryza					
Rictaxis punctostriatus					
Gastropod sp.					
TOTAL INDIVIDUALS	83	67	21	213	40
TOTAL SPECIES	3	3	2	3	2

A(51)

STATION—II AMPHIPODS SAMPLE SIZE $^1/_{128}$ M^2

SPECIES	IX-19-69	IX-26-69	XII-7-69	II-24-70	III-31-70	IX-16-70	VIII-3-70	VIII-3-70	X-1-70	I-11-71	III-1-71	X-6-71									
Ampelisca abdita																					
Ampelisca vadorum																					
Ampelisca verrilli																					
Byblis serrata																					
Ampeliscid juv.																					
Anonyx sp.																					
Lysianopsis alba																					
Orchomenella pinguis																					
Monoculodes edwardsi																					
Paraphoxus spinosus																					
Phoxocephalus holboili																					
Trichophoxus epistomus																					
Parametopella cypris																					
Stenothoe minuta																					
Gammarus annulatus																					
Gammarus mucronatus									1												
Gammarus lawrencianus																					
Gammarus juv.																					
Hyale plumulosa																					
Listriella barnardi																					
Listriella clymenellae																					
Idunella sp.																					
Batea catharinensis																					
Corophium sp. A																					
Corophium sp. B																					
Corophium acutum					6																
Corophium bonelli		NONE ALIVE	NONE ALIVE	NONE ALIVE		NONE ALIVE															
Corophium insidiosum																					
Corophium tuberculatum																					
Corophium juv.							1	3													
Cerapus tubularis																					
Erichthonius brasiliensis											1										
Erichthonius rubricornis																					
Lembos smithi										2											
Lembos websteri																					
Microdeutopus gryllotalpa																					
Rudilemboides naglei																					
Unciola dissimilis																					
Unciola irrorata																					
Ampithoe longimana																					
Cymadusa compta																					
Leptocheirus pinguis																					
Microprotopus raneyi																					
Elasmopus levis								1													
Jassa falcata					1							3									
Acanthohaustorius millsi																					
Bathyporeia quoddyensis																					
Luconacia incerta																					
Caprella penantis																					
Paracaprella tenuis																					
Unidentified heads																					
Unidentified juv.	1																				
Eye fragments																					
TOTAL INDIVIDUALS	1	0	0	0	7	0	1	4	1	2	1	3									
TOTAL SPECIES	1	0	0	0	2	0	1	2	1	1	1	1									

STATION—IV AMPHIPODS SAMPLE SIZE $\frac{1}{128}$ M^2

SPECIES	IX-21-69	X-9-69*	XII-7-69	II-22-70	IV-19-70	V-20-70	VI-15-70	VII-14-70	VIII-6-70	X-2-70	X-2-70	XI-11-70	XII-8-70	III-1-71	IV-26-71	VI-4-71	VII-8-71	VIII-9-71	XII-17-71	IV-13-72	V-26-72
Ampelisca andita																					
Ampelisca vadorum																					
Ampelisca verrilli																					
Byblis serrata																					
Ampeliscid juv.																					
Anonyx sp.																					
Lysianopsis alba																					
Orchomenella pinguis																					
Monoculodes edwardsi																					
Paraphoxus spinosus																					
Phoxocephalus holbolli																					
Trichophoxus epistomus																					
Parametopella cypris																					
Stenothoe minuta																					
Gammarus annulatus																					
Gammarus mucronatus										4											
Gammarus lawrencianus																					
Gammarus juv.																					
Hyale plumulosa																					
Listriella barnardi																					
Listriella clymenellae																					
Idunella sp.																					
Batea catharinensis																					
Corophium sp. A		0.1																			
Corophium sp. B																	1				
Corophium acutum																	2				
Corophium bonelli	NONE ALIVE		NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE		NONE ALIVE	NONE ALIVE		NONE ALIVE	NONE ALIVE				NONE ALIVE	NONE ALIVE	NONE ALIVE
Corophium insidiosum																					
Corophium tuberculatum																					
Corophium juv.																2		1			
Cerapus tubularis																					
Erichthonius brasiliensis																					
Erichthonius rubricornis																					
Lembos smithi																					
Lembos websteri																					
Microdeutopus gryllotalpa																					
Rudilemboides naglei																					
Unciola dissimilis																					
Unciola irrorata										1			1								
Ampithoe longimana																					
Cymadusa compta																					
Leptocheirus pinguis																					
Microprotopus raneyi																					
Elasmopus levis																					
Jassa falcata																	2	4			
Acanthohaustorius millsi																					
Bathyporeia quoddyensis																					
Luconacia incerta										1											
Caprella penantis																					
Paracaprella tenuis																					
Unidentified heads																					
Unidentified juv.																					
Eye fragments																					
TOTAL INDIVIDUALS	0	0.1	0	0	0	0	0	0	0	6	0	0	1	0	0	2	5	5	0	0	0
TOTAL SPECIES	0	1	0	0	0	0	0	0	0	3	0	0	1	0	0	1	3	2	0	0	0

*ADJUSTED FROM 12 x 12" SQUARE PUT THROUGH 0.297 MM SCREEN

STATION—5   **AMPHIPODS**   **SAMPLE SIZE $^1/_{25}$ M^2**

SPECIES	IX-27-69	X-22-69	XI-19-69	XII-18-69	IV-22-70	VI-17-70	VII-14-70	VIII-14-70	I-4-71	II-22-71
Ampelisca abdita							1			1
Ampelisca vadorum	7					2	3	1	17	
Ampelisca verrilli	2						1	1		
Byblis serrata	8						5	4		
Ampeliscid juv.							1			
Anonyx sp.									1	
Lysianopsis alba										
Orchomenella pinguis										
Monoculodes edwardsi										
Paraphoxus spinosus	1									
Phoxocephalus holbolli	1							1		
Trichophoxus epistomus										
Parametopella cypris										
Stenothoe minuta	1									
Gammarus annulatus										
Gammarus mucronatus										
Gammarus lawrencianus										
Gammarus juv.									1	
Hyale plumulosa										
Listriella barnardi										
Listriella clymenellae										
Idunella sp.										
Batea catharinensis										
Corophium sp. A								20		
Corophium sp. B										
Corophium acutum										
Corophium bonelli		NONE ALIVE	NONE ALIVE	NONE ALIVE		2				4
Corophium insidiosum										
Corophium tuberculatum										
Corophium juv.										
Cerapus tubularis										
Erichthonius brasiliensis										
Erichthonius rubricornis										
Lembos smithi										
Lembos websteri									1	
Microdeutopus gryllotalpa										
Rudilemboides naglei										
Unciola dissimilis										
Unciola irrorata										
Ampithoe longimana								1	2	1
Cymadusa compta								1		
Leptocheirus pinguis										
Microprotopus raneyi										
Elasmopus levis	1								2	
Jassa falcata								1		
Acanthohaustorius millsi					2	14				
Bathyporeia quoddyensis										
Luconacia incerta										
Caprella penantis	1							4		
Paracaprella tenuis										
Unidentified heads										
Unidentified juv.								1		
Eye fragments	8	2	4							
TOTAL INDIVIDUALS	22	0	0	0	2	18	11	35	24	6
TOTAL SPECIES	8	0	0	0	1	3	4	9	5	3

STATION—7 **AMPHIPODS** **SAMPLE SIZE** $^1/_{25}$ M^2

SPECIES	IX-23-69	X-14-69	XI-13-69	XII-17-69	XII-17-69
Ampelisca abdita					
Ampelisca vadorum	1				
Ampelisca verrilli	8				
Byblis serrata	4				
Ampeliscid juv.					
Anonyx sp.					
Lysianopsis alba					
Orchomenella pinguis					
Monoculodes edwardsi					
Paraphoxus spinosus					
Phoxocephalus holbolli					
Trichophoxus epistomus					
Parametopella cypris					
Stenothoe minuta					
Gammarus annulatus					
Gammarus mucronatus					
Gammarus lawrencianus					
Gammarus juv.					
Hyale plumulosa					
Listriella barnardi					
Listriella clymenellae					
Idunella sp.					
Batea catharinensis				1	
Corophium sp. A					
Corophium sp. B					
Corophium acutum					
Corophium bonelli		NONE ALIVE	NONE ALIVE		NONE ALIVE
Corophium insidiosum					
Corophium tuberculatum					
Corophium juv.					
Cerapus tubularis					
Erichthonius brasiliensis					
Erichthonius rubricornis					
Lembos smithi					
Lembos websteri					
Microdeutopus gryllotalpa					
Rudilemboides naglei					
Unciola dissimilis					
Unciola irrorata					
Ampithoe longimana					
Cymadusa compta					
Leptocheirus pinguis					
Microprotopus raneyi					
Elasmopus levis					
Jassa falcata					
Acanthohaustorius millsi					
Bathyporeia quoddyensis					
Luconacia incerta					
Caprella penantis					
Paracaprella tenuis					
Unidentified heads					
Unidentified juv.					
Eye fragments	7		6		
TOTAL INDIVIDUALS	13	0	0	1	0
TOTAL SPECIES	3	0	0	1	0

STATION—8 **AMPHIPODS** **SAMPLE SIZE** $^1/_{25}$ M^2

SPECIES	IX-27-69	X-22-69
Ampelisca abdita		
Ampelisca vadorum		
Ampelisca verrilli		
Byblis serrata		
Ampeliscid juv.		
Anonyx sp.		
Lysianopsis alba		
Orchomenella pinguis		
Monoculodes edwardsi		
Paraphoxus spinosus		
Phoxocephalus holbolli		
Trichophoxus epistomus		
Parametopella cypris		
Stenothoe minuta		
Gammarus annulatus		
Gammarus mucronatus		
Gammarus lawrencianus		
Gammarus juv.		
Hyale plumulosa		
Listriella barnardi		
Listriella clymenellae		
Idunella sp.		
Batea catharinensis		
Corophium sp. A		
Corophium sp. B		
Corophium acutum		
Corophium bonelli	NONE ALIVE	NONE ALIVE
Corophium insidiosum		
Corophium tuberculatum		
Corophium juv.		
Cerapus tubularis		
Erichthonius brasiliensis		
Erichthonius rubricornis		
Lembos smithi		
Lembos websteri		
Microdeutopus gryllotalpa		
Rudilemboides naglei		
Unciola dissimilis		
Unciola irrorata		
Ampithoe longimana		
Cymadusa compta		
Leptocheirus pinguis		
Microprotopus raneyi		
Elasmopus levis		
Jassa falcata		
Acanthohaustorius millsi		
Bathyporeia quoddyensis		
Luconacia incerta		
Caprella penantis		
Paracaprella tenuis		
Unidentified heads		
Unidentified juv.		
Eye fragments		
TOTAL INDIVIDUALS	0	0
TOTAL SPECIES	0	0

STATION—9 AMPHIPODS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-24-69	X-14-69	XI-17-69	XII-18-69	IV-8-70	V-15-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-12-70	XII-22-70	II-19-71	IV-26-71	VI-9-71	VIII-24-71	XII-29-71	III-23-72			
Ampelisca abdita										6	14	39	17	8	4	5	25	14			
Ampelisca vadorum	1									1	2	3		6	3	2	1	3			
Ampelisca verrilli	3								1		1					3					
Byblis serrata																					
Ampeliscid juv.										7		12	5		23	4	7				
Anonyx sp.																					
Lysianopsis alba																					
Orchomenella pinguis															1						
Monoculodes edwardsi													1		2						
Paraphoxus spinosus																					
Phoxocephalus holbolli															1						
Trichophoxus epistomus																					
Parametopella cypris																					
Stenothoe minuta																					
Gammarus annulatus																					
Gammarus mucronatus																					
Gammarus lawrencianus																					
Gammarus juv.																					
Hyale plumulosa																					
Listriella barnardi																2					
Listriella clymenellae																					
Idunella sp.																					
Batea catharinensis								2			2										
Corophium sp. A																					
Corophium sp. B																					
Corophium acutum														1	1						
Corophium bonelli			NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE														
Corophium insidiosum											1										
Corophium tuberculatum																		2			
Corophium juv.										2					1						
Cerapus tubularis																	1				
Erichthonius brasiliensis																					
Erichthonius rubricornis																					
Lembos smithi										1											
Lembos websteri																					
Microdeutopus gryllotalpa																					
Rudilemboides naglei																					
Unciola dissimilis																					
Unciola irrorata														1	4						
Ampithoe longimana																					
Cymadusa compta																					
Leptocheirus pinguis																					
Microprotopus raneyi										3	1										
Elasmopus levis																					
Jassa falcata		1							2					3		2					
Acanthohaustorius millsi																					
Bathyporeia quoddyensis																					
Luconacia incerta																					
Caprella penantis		2																			
Paracaprella tenuis		1																			
Unidentified heads																					
Unidentified juv.										1							1				
Eye fragments	26	20	30	21	26	28	48	34	22	6		6				5					
TOTAL INDIVIDUALS	4	4	0	0	0	0	0	2	3	21	21	54	23	19	40	18	35	19			
TOTAL SPECIES	2	3	0	0	0	0	0	1	2	5	6	2	2	5	8	5	4	3			

STATION— 10

AMPHIPODS

SAMPLE SIZE $^{1}/_{25}$ M^{2}

SPECIES	IX-22-69	IX-22-69	X-14-69	XI-17-69	XII-8-69	IV-6-70	V-10-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71	VI-10-71	VIII-24-71	XII-29-71	XII-29-71	III-23-72	III-23-72
Ampelisca abdita	2											13	15	11	5		40	7	8	42
Ampelisca vadorum	2			1									1		2		9	2		
Ampelisca verrilli	13	15		1										2	1		1	2		
Byblis serrata																				
Ampeliscid juv.											8		5		8		7			
Anonyx sp.															1					
Lysianopsis alba																	1			
Orchomenella pinguis																				
Monoculodes edwardsi																				
Paraphoxus spinosus																				
Phoxocephalus holbolli																				
Trichophoxus epistomus																				
Parametopella cypris																				
Stenothoe minuta																				
Gammarus annulatus																				
Gammarus mucronatus																				
Gammarus lawrencianus																				
Gammarus juv.																				
Hyale plumulosa																				
Listriella barnardi																				
Listriella clymenellae																				
Idunella sp.																				
Batea catharinensis												1	4							
Corophium sp. A																				
Corophium sp. B																				
Corophium acutum			2								1				1					
Corophium bonelli					NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE								2				
Corophium insidiosum																				
Corophium tuberculatum																	53	32	8	1
Corophium juv.									1				1							
Cerapus tubularis																	2	4		
Erichthonius brasiliensis																	2	61	1	
Erichthonius rubricornis																				
Lembos smithi													5				9			
Lembos websteri																				
Microdeutopus gryllotalpa																1				
Rudilemboides naglei																				
Unciola dissimilis																				
Unciola irrorata													2		4		1		2	
Ampithoe longimana			1																	
Cymadusa compta																		1		
Leptocheirus pinguis																				
Microprotopus raneyi												8					9	3	3	
Elasmopus levis													2	4			3			
Jassa falcata			1							1					7	3	1			
Acanthohaustorius millsi																				
Bathyporeia quoddyensis														2						
Luconacia incerta																				
Caprella penantis			4																	
Paracaprella tenuis														1			4	1	10	
Unidentified heads																				
Unidentified juv.											1		1	1						1
Eye fragments	5		25	18	69	27	23	63	26	12	20	1	8	7	2	2				
TOTAL INDIVIDUALS	17	15	8	2	0	0	0	0	1	1	10	22	36	21	29	6	142	113	32	44
TOTAL SPECIES	3	1	4	2	0	0	0	0	1	1	3	3	7	5	7	3	13	9	6	3

STATION— 20 AMPHIPODS SAMPLE SIZE $^1/_{25}$ M^2

SPECIES	IX-24-69	IX-24-69	X-16-69	XI-13-69	XI-19-69	XII-18-69	XII-18-69	I-6-70	III-19-70	III-19-70	IV-6-70	V-12-70	V-15-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71	
Ampelisca abdita			1															12	8	4	
Ampelisca vadorum	2	2			1								1	5	8	8	15	67	40	25	
Ampelisca verrilli	2	1							2							9	3	3		2	
Byblis serrata	17	9	1	1					4		1	1	2		11	27	12	13	4	5	
Ampeliscid juv.	2																19	7	5		
Anonyx sp.																					
Lysianopsis alba																					
Orchomenella pinguis																					
Monoculodes edwardsi																					
Paraphoxus spinosus																					
Phoxocephalus holbolli	2		1															1			
Trichophoxus epistomus																					
Parametopella cypris																					
Stenothoe minuta													1						2		
Gammarus annulatus																					
Gammarus mucronatus																					
Gammarus lawrencianus																					
Gammarus juv.																					
Hyale plumulosa																					
Listriella barnardi																					
Listriella clymenellae																					
Idunella sp.																					
Batea catharinensis																					
Corophium sp. A																					
Corophium sp. B																					
Corophium acutum																2	1	1	6		
Corophium bonelli								NONE ALIVE													
Corophium insidiosum																					
Corophium tuberculatum														1					1		
Corophium juv.																					
Cerapus tubularis																					
Erichthonius brasiliensis																					
Erichthonius rubricornis																					
Lembos smithi																					
Lembos websteri																					
Microdeutopus gryllotalpa																			1		
Rudilemboides naglei																					
Unciola dissimilis																					
Unciola irrorata				1			2		2		1	2		1	1	1			6	2	
Ampithoe longimana																			7		
Cymadusa compta																					
Leptocheirus pinguis																					
Microprotopus raneyi																		2	1		
Elasmopus levis																					
Jassa falcata										1									2		
Acanthohaustorius millsi																					
Bathyporeia quoddyensis																					
Luconacia incerta																					
Caprella penantis																					
Paracaprella tenuis																					
Unidentified heads						1													2		
Unidentified juv.																					
Eye fragments	4		33											2							
TOTAL INDIVIDUALS	25	12	3	2	1	1	2	0	8	1	2	3	4	7	20	47	50	105	85	38	
TOTAL SPECIES	4	3	3	2	1	1	1	0	3	1	2	2	3	3	3	5	4	7	11	5	

STATION—28 AMPHIPODS ALL TRAWL SAMPLES

SPECIES	IX-19-69	IX-27-69	I-6-70
Ampelisca abdita			
Ampelisca vadorum	46		
Ampelisca verrilli	458	1	
Byblis serrata	7		
Ampeliscid juv.	1		
Anonyx sp.			
Lysianopsis alba	34		
Orchomenella pinguis			
Monoculodes edwardsi			
Paraphoxus spinosus	12		
Phoxocephalus holbolli			
Trichophoxus epistomus	52		
Parametopella cypris			
Stenothoe minuta	2		
Gammarus annulatus			
Gammarus mucronatus			4
Gammarus lawrencianus	1		
Gammarus juv.			
Hyale plumulosa	2		
Listriella barnardi			
Listriella clymenellae	6		
Idunella sp.	1		
Batea catharinensis			
Corophium sp. A			
Corophium sp. B			
Corophium acutum	3		
Corophium bonelli			
Corophium insidiosum			
Corophium tuberculatum	1		
Corophium juv.			
Cerapus tubularis			
Erichthonius brasiliensis			
Erichthonius rubricornis			
Lembos smithi	2		
Lembos websteri			
Microdeutopus gryllotalpa			
Rudilemboides naglei			
Unciola dissimilis			
Unciola irrorata	23		
Ampithoe longimana	2		
Cymadusa compta			
Leptocheirus pinguis			
Microprotopus raneyi			
Elasmopus levis	44		
Jassa falcata			
Acanthohaustorius millsi	43	1	
Bathyporeia quoddyensis			
Luconacia incerta			
Caprella penantis			
Paracaprella tenuis	3		
Unidentified heads	3		
Unidentified juv.	1		
Eye fragments			
TOTAL INDIVIDUALS	747	2	4
TOTAL SPECIES	20	2	1

*ALL TRAWL SAMPLES

STATION–30 AMPHIPODS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-27-69	X-10-69	XI-17-69	XII-17-69	XI-17-70	IX-30-70	IX-22-71
Ampelisca abdita					1		12
Ampelisca vadorum							
Ampelisca verrilli							
Byblis serrata					4		
Ampeliscid juv.							
Anonyx sp.							
Lysianopsis alba							
Orchomenella pinguis							
Monoculodes edwardsi							
Paraphoxus spinosus							
Phoxocephalus holbolli							
Trichophoxus epistomus							
Parametopella cypris							
Stenothoe minuta							
Gammarus annulatus							
Gammarus mucronatus							
Gammarus lawrencianus							
Gammarus juv.							
Hyale plumulosa							
Listriella barnardi							
Listriella clymenellae							
Idunella sp.							
Batea catharinensis							
Corophium sp. A							
Corophium sp. B							1
Corophium acutum							
Corophium bonelli	NONE ALIVE	NONE ALIVE	NONE ALIVE	NONE ALIVE			
Corophium insidiosum						1	
Corophium tuberculatum					1		
Corophium juv.							
Cerapus tubularis						3	
Erichthonius brasiliensis							
Erichthonius rubricornis							
Lembos smithi							
Lembos websteri							
Microdeutopus gryllotalpa							
Rudilemboides naglei							1
Unciola dissimilis					1		1
Unciola irrorata							
Ampithoe longimana							
Cymadusa compta							
Leptocheirus pinguis							1
Microprotopus raneyi						15	3
Elasmopus levis					4		
Jassa falcata							
Acanthohaustorius millsi							
Bathyporeia quoddyensis							
Luconacia incerta							
Caprella penantis							
Paracaprella tenuis							
Unidentified heads							
Unidentified juv.							
Eye fragments	2	4				1	
TOTAL INDIVIDUALS	0	0	0	0	11	19	19
TOTAL SPECIES	0	0	0	0	4	3	6

STATION–31

AMPHIPODS SAMPLE SIZE $\frac{1}{25}$ M^2 EXCEPT WHERE OTHERWISE NOTED

SPECIES	IX-19*-69	IX-26-69	X-24-69	XI-17-69	XII-22-69	III-3†-70	V-12-70	VI-12-70	VII-14-70	VIII-18-70	IX-29-70	XI-10-70	XII-22-70	I-13-71	III-2-71	III-9-71	VIII-24-71	XI-29-71	III-23-72	IV-3-72	I-10-73
Ampelisca abdita																					
Ampelisca vadorum	1																				
Ampelisca verrilli	4																				
Byblis serrata																					
Ampeliscid juv.																					
Anonyx sp.																					
Lysianopsis alba	4																				
Orchomenella pinguis																					
Monoculodes edwardsi																					
Paraphoxus spinosus	4																				
Phoxocephalus holbolli																					
Trichophoxus epistomus	2																				
Parametopella cypris																					
Stenothoe minuta																					
Gammarus annulatus											1										
Gammarus mucronatus																					
Gammarus lawrencianus															5						
Gammarus juv.																					
Hyale plumulosa																					
Listriella barnardi																					
Listriella clymenellae																					
Idunella sp.																					
Batea catharinensis		1																			
Corophium sp. A					1																
Corophium sp. B																					
Corophium acutum																					
Corophium bonelli																1	1		1		
Corophium insidiosum			NONE ALIVE			NONE ALIVE	NONE ALIVE	NONE ALIVE					NONE ALIVE								
Corophium tuberculatum									1					1							
Corophium juv.															3				1		
Cerapus tubularis																	1				
Erichthonius brasiliensis																					
Erichthonius rubricornis										2					2				1		
Lembos smithi	2														4						
Lembos websteri																					
Microdeutopus gryllotalpa																					
Rudilemboides naglei														1			19		27	4	
Unciola dissimilis																					
Unciola irrorata	1																				
Ampithoe longimana																					
Cymadusa compta									2								13	1			
Leptocheirus pinguis																					
Microprotopus raneyi					1																
Elasmopus levis	5													1			7				
Jassa falcata				1												1					
Acanthohaustorius millsi	3									4				1			5	1			4
Bathyporeia quoddyensis																					
Luconacia incerta																					
Caprella penantis	3																				
Paracaprella tenuis																					
Unidentified heads												1									
Unidentified juv.																	19				
Eye fragments												1									
TOTAL INDIVIDUALS	29	1	0	1	2	0	0	0	3	6	1	1	0	4	14	2	65	2	30	4	4
TOTAL SPECIES	10	1	0	1	2	0	0	0	2	2	1	1	0	4	4	2	6	2	4	1	1

* TRAWL SAMPLE

† $\frac{1}{10}$ M^2 GRAB SAMPLE

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STATION—35 **AMPHIPODS** **SAMPLE SIZE $\frac{1}{25}$ M^2**

SPECIES	X-16-69	XI-13-69	XII-18-69	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	I-4-71	II-19-71	VIII-25-71
Ampelisca abdita	9	215	28	109	15	31	47	34	20	8	148	90	161	23
Ampelisca vadorum	6	74	55	102	179	75	77	43	31	13	41	9	151	14
Ampelisca verrilli	36	15	30	35	19	18	8	24	20	29	78	12	13	6
Byblis serrata	3	2	9	11	9			4	5		6	1	25	3
Ampeliscid juv.	6	7					23	77	15	3	120	11	6	57
Anonyx sp.														
Lysianopsis alba														
Orchomenella pinguis														
Monoculodes edwardsi														
Paraphoxus spinosus														
Phoxocephalus holbolli														
Trichophoxus epistomus														
Parametopella cypris					2							4		9
Stenothoe minuta					5									10
Gammarus annulatus														
Gammarus mucronatus														
Gammarus lawrencianus														
Gammarus juv.														
Hyale plumulosa														
Listriella barnardi			1									1		
Listriella clymenellae														
Idunella sp.														
Batea catharinensis					3							8	3	32
Corophium sp. A														
Corophium sp. B														
Corophium acutum							2		1	3			1	1
Corophium bonelli													1	
Corophium insidiosum														
Corophium tuberculatum					1				6	2	9	9	19	8
Corophium juv.			1				1	1	1				4	
Cerapus tubularis			1							1	4			
Erichthonius brasiliensis									10		1			5
Erichthonius rubricornis												3		
Lembos smithi														
Lembos websteri														
Microdeutopus gryllotalpa														
Rudilemboides naglei														
Unciola dissimilis														
Unciola irrorata		8	49	18	23	28	82	9	3	5	12	33	100	1
Ampithoe longimana														
Cymadusa compta														
Leptocheirus pinguis														1
Microprotopus raneyi												1		1
Elasmopus levis														
Jassa falcata					1							1		
Acanthohaustorius millsi														
Bathyporeia quoddyensis														
Luconacia incerta	5				29				60	1				45
Caprella penantis														
Paracaprella tenuis	1												1	
Unidentified heads														2
Unidentified juv.											1			
Eye fragments								4					1	
●														
TOTAL INDIVIDUALS	66	321	174	275	286	152	240	192	172	65	420	183	485	218
TOTAL SPECIES	6	5	8	5	11	4	6	6	9	8	8	12	10	14

STATION–36 AMPHIPODS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	XI-13-69	I-12*70	IV-6-70	IX-30-70	XI-12-70	I-4-71	II-19-71			
Ampelisca abdita		4.8		4	7	2	11			
Ampelisca vadorum	7	23.2	26	7	20	59	41			
Ampelisca verrilli	7	73.6	1	1	21	3	11			
Byblis serrata	65	108.8	6		156	8	83			
Ampeliscid juv.	1			2						
Anonyx sp.										
Lysianopsis alba										
Orchomenella pinguis										
Monoculodes edwardsi										
Paraphoxus spinosus										
Phoxocephalus holbolli			3	7		4				
Trichophoxus epistomus										
Parametopella cypris										
Stenothoe minuta										
Gammarus annulatus										
Gammarus mucronatus										
Gammarus lawrencianus										
Gammarus juv.										
Hyale plumulosa										
Listriella barnardi	2	0.8			3	1	2			
Listriella clymenellae										
Idunella sp.										
Batea catharinensis	1			1	1		5			
Corophium sp. A										
Corophium sp. B										
Corophium acutum										
Corophium bonelli			1							
Corophium insidiosum										
Corophium tuberculatum					1					
Corophium juv.										
Cerapus tubularis							1			
Erichthonius brasiliensis							8			
Erichthonius rubricornis										
Lembos smithi										
Lembos websteri										
Microdeutopus gryllotalpa										
Rudilemboides naglei						2				
Unciola dissimilis										
Unciola irrorata	1	5.2	2	1	15	11	15			
Ampithoe longimana										
Cymadusa compta										
Leptocheirus pinguis										
Microprotopus raneyi				3						
Elasmopus levis										
Jassa falcata			1							
Acanthohaustorius millsi										
Bathyporeia quoddyensis										
Luconacia incerta										
Caprella penantis										
Paracaprella tenuis										
Unidentified heads										
Unidentified juv.										
Eye fragments	1	2	1							
TOTAL INDIVIDUALS	84	216.4	40	26	224	90	177			
TOTAL SPECIES	6	6	7	7	8	8	9			

* ADJUSTED FROM $\frac{1}{10}$ M^2 VAN VEEN GRAB SAMPLE

STATION–37 AMPHIPODS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	XI-13-69	I-6-70	II-9*70	III-19-70		
Ampelisca abdita	51			1		
Ampelisca vadorum	60		2			
Ampelisca verrilli	17	3	8	7		
Byblis serrata	11		6			
Ampeliscid juv.						
Anonyx sp.						
Lysianopsis alba						
Orchomenella pinguis						
Monoculodes edwardsi						
Paraphoxus spinosus						
Phoxocephalus holbolli						
Trichophoxus epistomus						
Parametopella cypris						
Stenothoe minuta			0.4			
Gammarus annulatus						
Gammarus mucronatus						
Gammarus lawrencianus						
Gammarus juv.						
Hyale plumulosa						
Listriella barnardi						
Listriella clymenellae						
Idunella sp.						
Batea catharinensis			0.4			
Corophium sp. A						
Corophium sp. B						
Corophium acutum						
Corophium bonelli						
Corophium insidiosum						
Corophium tuberculatum						
Corophium juv.	2					
Cerapus tubularis	2					
Erichthonius brasiliensis	1					
Erichthonius rubricornis						
Lembos smithi						
Lembos websteri						
Microdeutopus gryllotalpa						
Rudilemboides naglei						
Unciola dissimilis						
Unciola irrorata	14		0.8			
Ampithoe longimana						
Cymadusa compta						
Leptocheirus pinguis						
Microprotopus raneyi						
Elasmopus levis						
Jassa falcata						
Acanthohaustorius millsi						
Bathyporeia quoddyensis						
Luconacia incerta						
Caprella penantis						
Paracaprella tenuis						
Unidentified heads						
Unidentified juv.						
Eye fragments		18	13.6			
TOTAL INDIVIDUALS	158	3	17.6	8		
TOTAL SPECIES	8	1	6	2		

* ADJUSTED FROM $\frac{1}{10}$ M^2 VAN VEEN GRAB

STATION-80 **AMPHIPODS SAMPLE SIZE $1/25\ M^2$**

SPECIES	VI-12-70	XI-18-70	VI-10-71					
Ampelisca abdita	1	17						
Ampelisca vadorum	52	44						
Ampelisca verrilli	2	5						
Byblis serrata	3	61						
Ampeliscid juv.	1							
Anonyx sp.								
Lysianopsis alba								
Orchomenella pinguis								
Monoculodes edwardsi			2					
Paraphoxus spinosus		1						
Phoxocephalus holbolli			5					
Trichophoxus epistomus								
Parametopella cypris								
Stenothoe minuta								
Gammarus annulatus								
Gammarus mucronatus								
Gammarus lawrencianus								
Gammarus juv.								
Hyale plumulosa								
Listriella barnardi	1	1						
Listriella clymenellae								
Idunella sp.								
Batea catharinensis		1	1					
Corophium sp. A								
Corophium sp. B								
Corophium acutum			1					
Corophium bonelli		1						
Corophium insidiosum	1							
Corophium tuberculatum								
Corophium juv.								
Cerapus tubularis		1						
Erichthonius brasiliensis		1						
Erichthonius rubricornis								
Lembos smithi		9						
Lembos websteri								
Microdeutopus gryllotalpa								
Rudilemboides naglei								
Unciola dissimilis								
Unciola irrorata	6	23	5					
Ampithoe longimana								
Cymadusa compta								
Leptocheirus pinguis								
Microprotopus raneyi								
Elasmopus levis		1						
Jassa falcata	1		3					
Acanthohaustorius millsi								
Bathyporeia quoddyensis								
Luconacia incerta								
Caprella penantis								
Paracaprella tenuis								
Unidentified heads								
Unidentified juv.								
Eye fragments								
TOTAL INDIVIDUALS	68	166	17					
TOTAL SPECIES	8	13	6					

STATION-90 **AMPHIPODS SAMPLE SIZE $1/25\ M^2$**

SPECIES	VIII-14-70	XI-18-70	I-4-71	II-22-71	IV-26-71	VI-10-71	VII-2-71	VIII-26-71	
Ampelisca abdita		4	11	11	3	5			
Ampelisca vadorum				1	1	8	1		
Ampelisca verrilli			2	3		17	4		
Byblis serrata		1						1	
Ampeliscid juv.			15				3		
Anonyx sp.									
Lysianopsis alba									
Orchomenella pinguis									
Monoculodes edwardsi			2			2			
Paraphoxus spinosus									
Phoxocephalus holbolli									
Trichophoxus epistomus									
Parametopella cypris									
Stenothoe minuta									
Gammarus annulatus									
Gammarus mucronatus									
Gammarus lawrencianus									
Gammarus juv.									
Hyale plumulosa									
Listriella barnardi				1					
Listriella clymenellae									
Idunella sp.									
Batea catharinensis									
Corophium sp. A									
Corophium sp. B									
Corophium acutum						1		3	
Corophium bonelli									
Corophium insidiosum									
Corophium tuberculatum			2	1		1			
Corophium juv.		4							
Cerapus tubularis									
Erichthonius brasiliensis									
Erichthonius rubricornis									
Lembos smithi									
Lembos websteri									
Microdeutopus gryllotalpa									
Rudilemboides naglei									
Unciola dissimilis									
Unciola irrorata	2	4	51	32	7	81	8	1	
Ampithoe longimana									
Cymadusa compta									
Leptocheirus pinguis			1			3			
Microprotopus raneyi								1	
Elasmopus levis									
Jassa falcata	7				1	9			
Acanthohaustorius millsi									
Bathyporeia quoddyensis									
Luconacia incerta									
Caprella penantis		1							
Paracaprella tenuis									
Unidentified heads									
Unidentified juv.									
Eye fragments									
TOTAL INDIVIDUALS	9	14	84	49	12	127	16	6	
TOTAL SPECIES	2	5	6	6	4	9	3	4	

AMPHIPODS SAMPLE SIZE $^1/_{128}$ M^2

STATION—SIPPEWISSETT MARSH

SPECIES		SIPP 3 II-24-70		SIPP 4 II-24-70		SIPP 7 VIII-6-70		SIPP 8 VIII-13-70	I-11-71												
Ampelisca abdita				2																	
Ampelisca vadorum																					
Ampelisca verrilli																					
Byblis serrata																					
Ampeliscid juv.																					
Anonyx sp.																					
Lysianopsis alba																					
Orchomenella pinguis																					
Monoculodes edwardsi																					
Paraphoxus spinosus																					
Phoxocephalus holbolli																					
Trichophoxus epistomus																					
Parametopella cypris																					
Stenothoe minuta																					
Gammarus annulatus																					
Gammarus mucronatus																					
Gammarus lawrencianus																					
Gammarus juv.																					
Hyale plumulosa																					
Listriella barnardi																					
Listriella clymenellae																					
Idunella sp.																					
Batea catharinensis																					
Corophium sp. A																					
Corophium sp. B																					
Corophium acutum																					
Corophium bonelli		NONE ALIVE				NONE ALIVE															
Corophium insidiosum																					
Corophium tuberculatum																					
Corophium juv.																					
Cerapus tubularis																					
Erichthonius brasiliensis																					
Erichthonius rubricornis																					
Lembos smithi																					
Lembos websteri																					
Microdeutopus gryllotalpa				1																	
Rudilemboides naglei																					
Unciola dissimilis																					
Unciola irrorata																					
Ampithoe longimana																					
Cymadusa compta																					
Leptocheirus pinguis																					
Microprotopus raneyi																					
Elasmopus levis																					
Jassa falcata								3													
Acanthohaustorius millsi																					
Bathyporeia quoddyensis									1												
Luconacia incerta																					
Caprella penantis																					
Paracaprella tenuis																					
Unidentified heads																					
Unidentified juv.																					
Eye fragments																					
TOTAL INDIVIDUALS		0		3		0		3	1												
TOTAL SPECIES		0		2		0		1	1												

STATION—II **MISCELLANEOUS GROUPS** **SAMPLE SIZE $\frac{1}{128}$ M^2**

SPECIES	IX-19-69	IX-26-69	XII-7-69	II-24-70	III-31-70	VI-16-70	VIII-3-70	VIII-3-70	X-1-70	I-11-71	III-1-71	X-6-71						
Porifera											NONE ALIVE							
Coelenterata																		
Cerianthus americanus																		
Sp. A																		
Sp. B																		
Sp. C									3									
Sp. D																		
Turbellaria																		
Sp. A						3	2	3	2	4								
Acoela Sp. A																		
Acoela Sp. B																		
Nemertina																		
Tubulanus pellucidus																		
Sp. B																		
Sp. C												2						
Sp. D																		
Nemertine juvs.																		
Kinorhyncha																		
Archiannelida																		
Oligochaeta	91	40	104	14	20	14		2	7	21								
Polyplacophora																		
Acarina	4		3	6	2													
Pycnogonida																		
Tanystylum orbiculare																		
Callipallene brevirostris																		
Anoplodactylus lentus																		
Pycnogonid juv.																		
Cephalocarida																		
Hutchinsoniella macracantha																		
Ostracoda	22	3																
Cirripedia																		
Mysidacea																		
Cumacea																		
Cyclaspis varians																		
Leptocuma minor																		
Leucon americanus																		
Diastylis quadrispinosa																		
Diastylis sp.																		
Oxyurostylis smithi																		
Cumacean juv.																		
Tanaidacea																		
Leptochelia savignyi	4	1																
Leptognathia sp.	2	1							1									
Isopoda																		
Chiridotea tuftsi																		
Idotea baltica																		
Edotea montosa	1	1																
Erichsonella filiformis																		
Erichsonella sp.																		
Anthurid sp. (Ptilanthura?)																		
Sphaeroma quadridentatum																		

STATION–II (cont.) **MISCELLANEOUS GROUPS**

SPECIES	IX-19-69	IX-26-69	XII-7-69	II-24-70	III-31-70	III-16-70	VIII-3-70	VIII-3-70	X-1-70	I-11-71	III-1-71	X-6-71
Decapoda											NONE ALIVE	
Palaemonetes vulgaris												
Crangon septemspinosa												
Hippolyte pleuracantha												
Upogebia affinis												
Pagurus longicarpus												
Pagurus annulipes												
Callinectes sapidus												
Cancer irroratus												
Carcinus maenus												
Neopanope texana												
Panopeus herbstii												
Pinnotheres maculatum												
Pinnixa chaetopterana												
Libinia dubia												
Decapoda juv.												
Sipunculida												
Phascolion strombi												
Sipunculid sp.												
Echiurid sp.												
Asteroid sp.												
Ophiuroidea												
Amphioplus abditus												
Echinoid sp.												
Holothuroidea												
Cucumaria pulcherrima												
Leptosynapta sp.												
Enteropneusta												
Ascidiacea												
Bostrichobranchus pilularis								2				
Perophora viridis												
Pisces												
TOTAL INDIVIDUALS	7	3	0	0	0	3	2	5	6	4	0	2
TOTAL SPECIES	3	3	0	0	0	1	1	2	3	1	0	1
TOTAL NO. OF MISC. ANIMALS	124	46	107	20	22	17	2	7	13	25	0	2

STATION—IV MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{128}$ M^2

SPECIES	IX-21-69	X-9-69°	XII-7-69	II-22-70	IV-19-70	V-20-70	VI-15-70	VII-14-70	VIII-6-70	X-2-70	X-2-70	XI-11-70	XII-8-70	III-1-71	IV-26-71	VI-4-71	VII-8-71	VIII-9-71	XII-17-71	IV-13-72	V-26-72
Porifera																					
Coelenterata																					
Cerianthus americanus																					
Sp. A																					
Sp. B																					
Sp. C																					
Sp. D																					
Turbellaria																					
Sp. A									14												
Acoela Sp. A																					
Acoela Sp. B																					
Nemertina																					
Tubulanus pellucidus										1											
Sp. B																					
Sp. C																					
Sp. D																					
Nemertine juvs.												1						1			
Kinorhyncha																					
Archiannelida																					
Oligochaeta	18	38.1	20	194	65	47	103	9	15	13	4	42	4	4	15	98	110	8	9	13	126
Polyplacophora																					
Acarina	1	5.2			2										1						1
Pycnogonida																					
Tanystylum orbiculare																					
Callipallene brevirostris																					
Anoplodactylus lentus																					
Pycnogonid juv.																					
Cephalocarida																					
Hutchinsoniella macracantha																					
Ostracoda		0.9		1													1	13	3	1	3
Cirripedia																					
Mysidacea																					
Cumacea																					
Cyclaspis varians																					
Leptocuma minor												1									
Leucon americanus																					
Diastylis quadrispinosa																					
Diastylis sp.																					
Oxyurostylis smithi																					
Cumacean juv.																					
Tanaidacea																					
Leptochelia savignyi																					
Leptognathia sp.	1																				
Isopoda																					
Chiridotea tuftsi																					
Idotea baltica																					
Edotea montosa																					
Erichsonella filiformis																					
Erichsonella sp.																					
Anthurid sp. (Ptilanthura?)														1							
Sphaeroma quadridentatum																					

STATION—IV (cont.)

MISCELLANEOUS GROUPS

SPECIES	IX-21-69	X-9-69*	XII-7-69	II-22-70	IV-19-70	V-20-70	VI-15-70	VII-14-70	VIII-6-70	X-2-70	X-2-70	XI-11-70	XII-8-70	III-1-71	IV-26-71	VI-4-71	VIII-8-71	VIII-9-71	XII-17-71	IV-13-72	V-26-72
Decapoda																					
Palaemonetes vulgaris																					
Crangon septemspinosa																					
Hippolyte pleuracantha																					
Upogebia affinis																					
Pagurus longicarpus										1											
Pagurus annulipes																					
Callinectes sapidus																					
Cancer irroratus																					
Carcinus maenus																					
Neopanope texana																					
Panopeus herbstii										1											
Pinnotheres maculatum																					
Pinnixa chaetopterana																					
Libinia dubia																					
Decapoda juv.																					
Sipunculida																					
Phascolion strombi																					
Sipunculid sp.												1									1
Echiurid sp.																					
Asteroid sp.																					
Ophiuroidea																					
Amphioplus abditus																					
Echinoid sp.																					
Holothuroidea																					
Cucumaria pulcherrima																					
Leptosynapta sp.																					
Enteropneusta																					
Ascidiacea																					
Bostrichobranchus pilularis																					
Perophora viridis																					
Pisces																					
TOTAL INDIVIDUALS	1	0	0	0	0	0	0	0	14	3	0	2	0	1	0	0	0	0	0	0	1
TOTAL SPECIES	1	0	0	0	0	0	0	0	1	3	0	2	0	1	0	0	0	0	0	0	1
TOTAL NO. OF MISC. ANIMALS	20	44.2	20	195	67	47	103	9	29	16	4	45	4	5	16	98	111	12	12	14	131

*12" SQUARE SAMPLE PUT THROUGH 0.297 mm SCREEN

STATION—5 MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-27-69	X-22-69	XI-19-69	XII-18-69	IV-22-70	VI-17-70	VII-14-70	VIII-14-70	I-4-71	II-22-71
Porifera				2		2				
Coelenterata										
Cerianthus americanus										
Sp. A	2	1	1			3				
Sp. B					2					
Sp. C										
Sp. D										
Turbellaria										
Sp. A		2								
Acoela Sp. A		13		12	3	10	24	23	13	5
Acoela Sp. B				1						
Nemertina										
Tubulanus pellucidus	12	16	16	3	7	2	4	5	20	12
Sp. B	21	19	14	15	5	3	2	6	10	4
Sp. C					3	2				
Sp. D										
Nemertine juvs.										
Kinorhyncha										3
Archiannelida	3	6	9	16	9	6	5	10	21	
Oligochaeta	391	282	368	491	386	388	275	200	149	209
Polyplacophora										
Acarina	18	6	23		6		12			
Pycnogonida										
Tanystylum orbiculare										
Callipallene brevirostris	1		1							1
Anoplodactylus lentus		2					4	1		
Pycnogonid juv.										
Cephalocarida										
Hutchinsoniella macracantha										1
Ostracoda	39	12	5	3	9	4	32	79	47	7
Cirripedia			100							
Mysidacea										
Cumacea										
Cyclaspis varians	2									
Leptocuma minor								1		
Leucon americanus										
Diastylis quadrispinosa										
Diastylis sp.										
Oxyurostylis smithi	1	1				1	1	1		
Cumacean juv.										
Tanaidacea										
Leptochelia savignyi	1									1
Leptognathia sp.	7	8		7	4	12	30			
Isopoda										
Chiridotea tuftsi										
Idotea baltica										
Edotea montosa										
Erichsonella filiformis										
Erichsonella sp.										
Anthurid sp. (Ptilanthura?)							6			
Sphaeroma quadridentatum										

STATION—5 (cont.) **MISCELLANEOUS GROUPS**

SPECIES	IX-27-69	X-22-69	XI-19-69	XII-18-69	IV-22-70	VI-17-70	VII-14-70	VIII-14-70	I-4-71	II-22-71
Decapoda										
Palaemonetes vulgaris										
Crangon septemspinosa		1					1			
Hippolyte pleuracantha										
Upogebia affinis										
Pagurus longicarpus	1		1		1		2	1	1	
Pagurus annulipes										
Callinectes sapidus										
Cancer irroratus										
Carcinus maenus							1			
Neopanope texana										
Panopeus herbstii								1	2	1
Pinnotheres maculatum										
Pinnixa chaetopterana	7	3								1
Libinia dubia						1				
Decapoda juv.								6		
Sipunculida										
Phascolion strombi	2	2		2	3	2	1	8	9	15
Sipunculid sp.			1							
Echiurid sp.										
Asteroid sp.								8		
Ophiuroidea										
Amphioplus abditus	1									5
Echinoid sp.										
Holothuroidea										
Cucumaria pulcherrima							1	1		
Leptosynapta sp.										
Enteropneusta	1	7	3	3	3	1	4		1	
Ascidiacea										
Bostrichobranchus pilularis	10	7				3	6	4		
Perophora viridis	13									
Pisces										
TOTAL INDIVIDUALS	84	61	43	56	37	45	88	76	76	46
TOTAL SPECIES	15	13	7	7	9	11	14	14	7	10
TOTAL NO. OF MISC. ANIMALS	533	388	542	555	441	440	411	355	273	265

STATION—7 MISCELLANEOUS GROUPS SAMPLE SIZE $^1/_{25}$ M^2

SPECIES		IX-23-69	X-14-69	XI-13-69	XII-17-69	XII-17-69			
Porifera									
Coelenterata									
Cerianthus americanus									
Sp. A									
Sp. B									
Sp. C									
Sp. D									
Turbellaria									
Sp. A									
Acoela Sp. A									
Acoela Sp. B									
Nemertina									
Tubulanus pellucidus		5	42	10	34	6			
Sp. B			4		1				
Sp. C			2						
Sp. D									
Nemertine juvs.									
Kinorhyncha		2	3	4	2	9			
Archiannelida									
Oligochaeta				24	321	151			
Polyplacophora									
Acarina		1	1		16	88			
Pycnogonida									
Tanystylum orbiculare									
Callipallene brevirostris									
Anoplodactylus lentus									
Pycnogonid juv.									
Cephalocarida									
Hutchinsoniella macracantha									
Ostracoda		12	5	21	9	28			
Cirripedia									
Mysidacea									
Cumacea									
Cyclaspis varians									
Leptocuma minor									
Leucon americanus									
Diastylis quadrispinosa									
Diastylis sp.									
Oxyurostylis smithi				1	3				
Cumacean juv.									
Tanaidacea									
Leptochelia savignyi									
Leptognathia sp.									
Isopoda									
Chiridotea tuftsi									
Idotea baltica									
Edotea montosa									
Erichsonella filiformis									
Erichsonella sp.									
Anthurid sp. (Ptilanthura?)						1			
Sphaeroma quadridentatum									

STATION—7 (cont.) MISCELLANEOUS GROUPS

SPECIES		IX-23-69	X-14-69	XI-13-69	XII-17-69	XII-17-69	
Decapoda							
Palaemonetes vulgaris							
Crangon septemspinosa		1					
Hippolyte pleuracantha							
Upogebia affinis							
Pagurus longicarpus					1		
Pagurus annulipes							
Callinectes sapidus							
Cancer irroratus							
Carcinus maenus							
Neopanope texana							
Panopeus herbstii					1		
Pinnotheres maculatum			1				
Pinnixa chaetopterana		9	10		3		
Libinia dubia							
Decapoda juv.							
Sipunculida							
Phascolion strombi		8	12	5			
Sipunculid sp.							
Echiurid sp.							
Asteroid sp.							
Ophiuroidea							
Amphioplus abditus					1		
Echinoid sp.							
Holothuroidea							
Cucumaria pulcherrima							
Leptosynapta sp.							
Enteropneusta			1			1	
Ascidiacea							
Bostrichobranchus pilularis			8				
Perophora viridis							
Pisces							
TOTAL INDIVIDUALS		23	79	16	44	7	
TOTAL SPECIES		4	7	3	7	2	
TOTAL NO. OF MISC. ANIMALS		38	89	65	392	284	

STATION—B MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-27-69	X-22-69							
Porifera									
Coelenterata									
Ceriantius americanus	15	16							
Sp. A									
Sp. B									
Sp. C									
Sp. D									
Turbellaria									
Sp. A									
Acoela Sp. A									
Acoela Sp. B									
Nemertina									
Tubulanus pellucidus	5	11							
Sp. B									
Sp. C									
Sp. D									
Nemertine juvs.	6	4							
Kinorhyncha	1	2							
Archiannelida									
Oligochaeta									
Polyplacophora									
Acarina		51							
Pycnogonida									
Tanystylum orbiculare									
Callipallene brevirostris									
Anoplodactylus lentus									
Pycnogonid juv.									
Cephalocarida									
Hutchinsoniella macracantha									
Ostracoda	15	8							
Cirripedia									
Mysidacea									
Cumacea									
Cyclaspis varians									
Leptocuma minor									
Leucon americanus									
Diastylis quadrispinosa									
Diastylis sp.		2							
Oxyurostylis smithi									
Cumacean juv.									
Tanaidacea									
Leptochelia savignyi	5	3							
Leptognathia sp.									
Isopoda									
Chiridotea tuftsi									
Idotea baltica									
Edotea montosa									
Erichsonella filiformis									
Erichsonella sp.									
Anthurid sp. (Ptilanthura?)									
Spaeroma quadridentatum									

STATION—B (cont.) MISCELLANEOUS GROUPS

SPECIES	IX-27-69	X-22-69					
Decapoda							
Palaemonetes vulgaris							
Crangon septemspinosa	1	1					
Hippolyte pleuracantha							
Upogebia affinis							
Pagurus longicarpus							
Pagurus annulipes							
Callinectes sapidus							
Cancer irroratus							
Carcinus maenus							
Neopanope texana	1						
Panopeus herbstii							
Pinnotheres maculatum							
Pinnixa chaetopterana							
Libinia dubia	1						
Decapoda juv.							
Sipunculida							
Phascolion strombi							
Sipunculid sp.		3					
Echiurid sp.							
Asteroid sp.							
Ophiuroidea							
Amphioplus abditus							
Echinoid sp.							
Holothuroidea							
Cucumaria pulcherrima							
Leptosynapta sp.	1						
Enteropneusta							
Ascidiacea							
Bostrichobranchus pilularis							
Perophora viridis							
Pisces							
TOTAL INDIVIDUALS	29	36					
TOTAL SPECIES	7	6					
TOTAL NO. OF MISC. ANIMALS	51	101					

STATION–9 MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{25}$ M²

SPECIES	IX-24-69	X-14-69	XI-17-69	XII-18-69	IV-8-70	V-15-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-12-70	XII-22-70	II-19-71	IV-26-71	VI-9-71	VIII-24-71	XII-29-71	III-23-72			
Porifera										1											
Coelenterata																					
Cerianthus americanus																					
Sp. A									1												
Sp. B		3												1							
Sp. C																					
Sp. D																					
Turbellaria																					
Sp. A										9	12				1	6	2				
Acoela Sp. A						1				2			6	9	4	1		1			
Acoela Sp. B																					
Nemertina																					
Tubulanus pellucidus	87	93	17	40		1			2	38	27	26	45	16	16	85	18	11			
Sp. B		45	4						1	15	55	58	23	33	5	40	26	19			
Sp. C																					
Sp. D	2																	2			
Nemertine juvs.								1								4					
Kinorhyncha	17	24	16	10	10	1	2			1	2	1		1		24	3	3			
Archiannelida																					
Oligochaeta	160	193	159	107	82	53	55	37	26	84	198	106	150	136	94	145	112	121			
Polyplacophora																					
Acarina		7	9	1	13	6							114	3		1	3	11			
Pycnogonida																					
Tanystylum orbiculare																					
Callipallene brevirostris																					
Anoplodactylus lentus			1																		
Pycnogonid juv.																					
Cephalocarida																					
Hutchinsoniella macracantha		1					1														
Ostracoda	8	1	3	1				1			5	8	10	4	24	40	33	55			
Cirripedia																	1				
Mysidacea	2														2			1			
Cumacea																					
Cyclaspis varians																1					
Leptocuma minor														1							
Leucon americanus																					
Diastylis quadrispinosa																					
Diastylis sp.	1																				
Oxyurostylis smithi			1				1			2	3	1	4	1	1		1				
Cumacean juv.																					
Tanaidacea																					
Leptochelia savignyi																					
Leptognathia sp.																					
Isopoda																					
Chiridotea tuftsi																					
Idotea baltica																					
Edotea montosa										13	1				1		2				
Erichsonella filiformis																					
Erichsonella sp.																					
Anthurid sp. (Ptilanthura?)																					
Sphaeroma quadridentatum																					

STATION—9 (cont.)

MISCELLANEOUS GROUPS

SPECIES	IX-24-69	X-14-69	XI-17-69	XII-18-69	IV-8-70	V-15-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-12-70	XII-22-70	II-19-71	IV-26-71	VI-9-71	VIII-24-71	XII-29-71	III-23-72			
Decapoda																					
Palaemonetes vulgaris																					
Crangon septemspinosa																					
Hippolyte pleuracantha																					
Upogebia affinis																					
Pagurus longicarpus	2								1			1									
Pagurus annulipes																					
Callinectes sapidus																					
Cancer irroratus																					
Carcinus maenus																					
Neopanope texana																					
Panopeus herbstii						1					1										
Pinnotheres maculatum																					
Pinnixa chaetopterana	11	5	2			1	1		6	2	7	4		2		3					
Libinia dubia																					
Decapoda juv.																					
Sipunculida																					
Phascolion strombi	3	1	2										2	5		20	15	15			
Sipunculid sp.								1	7	10	23	12									
Echiurid sp.					2																
Asteroid sp.									1												
Ophiuroidea																					
Amphioplus abditus									1				2				2				
Echinoid sp.																					
Holothuroidea																					
Cucumaria pulcherrima									1												
Leptosynapta sp.																1					
Enteropneusta	2	4							1							3					
Ascidiacea																					
Bostrichobranchus pilularis																1					
Perophora viridis																					
Pisces																					
TOTAL INDIVIDUALS	86	148	27	40	2	4	3	1	21	88	129	102	82	68	28	166	65	51			
TOTAL SPECIES	6	6	6	1	1	4	3	1	9	8	8	6	6	8	6	9	7	5			
TOTAL NO. OF MISC. ANIMALS	275	377	216	159	107	64	60	40	48	174	334	217	356	212	148	383	216	242			

STATION–10 MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-22-69	X-14-69	XI-17-69	XII-18-69	IV-6-70	V-10-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71	VI-10-71	VIII-24-71	XII-29-71	XII-29-71	III-23-72	III-23-72		
Porifera	6									1						2		26	9		
Coelenterata																					
Cerianthus americanus																					
Sp. A		5							1									2	8		
Sp. B									1										2		
Sp. C																					
Sp. D																					
Turbellaria																					
Sp. A		1	3	1			1		2	13						2					
Acoela Sp. A					1			1										1	3		
Acoela Sp. B																6					
Nemertina																					
Tubulanus pellucidus	95	97	59	66	3	3	6	1	9	55	43	19	36	19	2	9	10	8	5		
Sp. B		35	3		5	1					33	51		2		60	48	13	18		
Sp. C																	1				
Sp. D									4												
Nemertine juvs.									2												
Kinorhyncha	4	24		43	13	4	24	4	7	3		15	2	2		22	4	1	3		
Archiannelida																					
Oligochaeta	177	226	139	132	226	195	164	108	111	184	157	205	1420	203	25	149	267	50	45		
Polyplacophora																					
Acarina	4	1		2	3	7	4	10	7	9	48	23	6	11	3	17		15	7		
Pycnogonida																					
Tanystylum orbiculare																					
Callipallene brevirostris																					
Anoplodactylus lentus		1	1						1												
Pycnogonid juv.													1								
Cephalocarida																					
Hutchinsoniella macracantha	1	2						1						4							
Ostracoda	11	14		2				2	12	2	9	5	6	32	1	52	41	196	95		
Cirripedia			1													586	99		1		
Mysidacea	2													4							
Cumacea																					
Cyclaspis varians													1						1		
Leptocuma minor											1										
Leucon americanus																					
Diastylis quadrispinosa														18							
Diastylis sp.																					
Oxyurostylis smithi				1							1	2				2	2				
Cumacean juv.																					
Tanaidacea																					
Leptochelia savignyi																					
Leptognathia sp.	2												3								
Isopoda																					
Chiridotea tuftsi																					
Idotea baltica																					
Edotea montosa						1			1	5						5	2		1		
Erichsonella filiformis																					
Erichsonella sp.													1								
Anthurid sp. (Ptilanthura?)																					
Sphaeroma quadridentatum																					

STATION—10 (cont.)

MISCELLANEOUS GROUPS

SPECIES	IX-22-69	X-14-69	XI-17-69	XII-18-69	IV-6-70	V-10-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71	VI-10-71	VIII-24-7	XII-29-71	III-29-71	III-23-72	III-23-72		
Decapoda																					
Palaemonetes vulgaris																					
Crangon septemspinosa								1						4				1	2		
Hippolyte pleuracantha																					
Upogebia affinis																					
Pagurus longicarpus																					
Pagurus annulipes																4		2	2		
Callinectes sapidus																					
Cancer irroratus																					
Carcinus maenus																					
Neopanope texana																					
Panopeus herbstii										2	2	2			2			1			
Pinnotheres maculatum	1																				
Pinnixa chaetopterana	2	1							7	1	4		3	1							
Libinia dubia																					
Decapoda juv.																					
Sipunculida																					
Phascolion strombi	4	5	4	1	1	2			2	18	2	5	10			23	18	29	6		
Sipunculid sp.				3		4			8		10										
Echiurid sp.																					
Asteroid sp.									2		1										
Ophiuroidea																					
Amphioplus abditus									1	5							2	2	3		
Echinoid sp.																					
Holothuroidea																					
Cucumaria pulcherrima									1												
Leptosynapta sp.									3												
Enteropneusta		1		1					6												
Ascidiacea																					
Bostrichobranchus pilularis																					
Perophora viridis																					
Pisces																					
TOTAL INDIVIDUALS	105	147	71	72	10	11	7	4	43	99	97	79	55	48	4	111	83	59	52		
TOTAL SPECIES	6	8	6	5	4	5	2	4	14	7	9	5	7	6	2	8	7	9	12		
TOTAL NO. OF MISC. ANIMALS	311	413	210	252	252	217	199	128	188	298	311	327	1489	300	33	942	494	347	211		

STATION – 20 MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	IX-24-69	X-16-69	XI-13-69	XII-18-69	I-6-70	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71
Porifera				2								1	1		
Coelenterata															
Cerianthus americanus															
Sp. A	1	1	2			4	1								3
Sp. B				1	1								2		
Sp. C															
Sp. D															
Turbellaria															
Sp. A			3			6						2		12	
Acoela Sp. A	8	10		11	19	2	1	7	9	2	3	24	5	17	20
Acoela Sp. B										2			2		
Nemertina															
Tubulanus pellucidus	5	5	7	5	15	2	1	2		1	4	68	38	16	28
Sp. B	4	53	72	31	32	14	14	2	1	5	6	11	26	8	17
Sp. C				4									1		
Sp. D	2	2	2							1	3				
Nemertine juvs.						7		2				1	4		
Kinorhyncha		3		1										1	2
Archiannelida	31	76	8	13	5	12	17	11	12	17		10	15	26	
Oligochaeta	211	710	162	191	179	150	295	519	210	304	405	311	239	153	211
Polyplacophora					1								1		
Acarina	11	19		8	6	2	18	4	6	6	8	7	10	5	35
Pycnogonida															
Tanystylum orbiculare															
Callipallene brevirostris															1
Anoplodactylus lentus		1		3		1				9	1	1	1		
Pycnogonid juv.															
Cephalocarida															
Hutchinsoniella macracantha															
Ostracoda	8	11	50	10	50		2	11	7	26		81	71	26	
Cirripedia														49	
Mysidacea															
Cumacea															
Cyclaspis varians		1													
Leptocuma minor												7	9		
Leucon americanus															
Diastylis quadrispinosa															
Diastylis sp.															
Oxyurostylis smithi		3	1	1					1	7	1		11	3	1
Cumacean juv.															
Tanaidacea															
Leptochelia savignyi												1			
Leptognathia sp.	6	20	4	3	3	1	1		3	1	1		12		4
Isopoda															
Chiridotea tuftsi															
Idotea baltica															
Edotea montosa		1	1							1	1		11	2	1
Erichsonella filiformis															
Erichsonella sp.															
Anthurid sp. (Ptilanthura?)															
Sphaeroma quadridentatum															

STATION– 20 (cont.) MISCELLANEOUS GROUPS

SPECIES	IX-24-69	X-16-69	XI-13-69	XII-18-69	I-6-70	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	XII-22-70	II-19-71
Decapoda															
Palaemonetes vulgaris															
Crangon septemspinosa															
Hippolyte pleuracantha															
Upogebia affinis															
Pagurus longicarpus	1	1			1					1		1			
Pagurus annulipes															
Callinectes sapidus															
Cancer irroratus															
Carcinus maenus															
Neopanope texana															
Panopeus herbstii							1				1		1		
Pinnotheres maculatum															
Pinnixa chaetopterana	4	2	1	1	2	2					2	1		1	
Libinia dubia	1		1							1					
Decapoda juv.															
Sipunculida															
Phascolion strombi	5	1	3	3	1	2		1		2		1	7	3	3
Sipunculid sp.			1		2	1					2	2		4	2
Echiurid sp.															
Asteroid sp.															
Ophiuroidea															
Amphioplus abditus											1	1		1	1
Echinoid sp.															
Holothuroidea															
Cucumaria pulcherrima										3		1			
Leptosynapta sp.															
Enteropneusta	8	5	6		11	4				1		3			
Ascidiacea															
Bostrichobranchus pilularis	5	23	6	3		1		1	4	55	8	27	6	1	4
Perophora viridis															
Pisces															
TOTAL INDIVIDUALS	73	200	110	79	82	48	36	24	30	108	34	158	148	94	85
TOTAL SPECIES	12	15	14	12	11	12	7	6	6	15	13	15	16	12	12
TOTAL NO. OF MISC. ANIMALS	311	948	328	291	328	211	351	560	253	445	447	562	473	328	333

STATION– 28 MISCELLANEOUS GROUPS ALL TRAWL SAMPLES

SPECIES	IX-19-69*	IX-27-69*	I-6-70*
Porifera			
Coelenterata			
Cerianthus americanus			
Sp. A	1		
Sp. B			
Sp. C			
Sp. D			
Turbellaria			
Sp. A			
Acoela Sp. A			
Acoela Sp. B			
Nemertina			
Tubulanus pellucidus			
Sp. B			
Sp. C			48
Sp. D	1		
Nemertine juvs.	3		
Kinorhyncha			
Archiannelida			
Oligochaeta	124		
Polyplacophora			
Acarina	13	2	10
Pycnogonida			
Tanystylum orbiculare	1	2	2
Callipallene brevirostris			
Anoplodactylus lentus			
Pycnogonid juv.			
Cephalocarida			
Hutchinsoniella macracantha			
Ostracoda	31		8
Cirripedia			
Mysidacea			
Cumacea			
Cyclaspis varians			
Leptocuma minor	14	1	
Leucon americanus			
Diastylis quadrispinosa			
Diastylis sp.			
Oxyurostylis smithi	13		
Cumacean juv.			
Tanaidacea			
Leptochelia savignyi	16	9	
Leptognathia sp.	286		
Isopoda			
Chiridotea tuftsi	3		
Idotea baltica			1
Edotea montosa	1		3
Erichsonella filiformis	10		
Erichsonella sp.			
Anthurid sp. (Ptilanthura?)	4		
Sphaeroma quadridentatum	58	2	

STATION– 28 (cont.) MISCELLANEOUS GROUPS

SPECIES	IX-19-69*	IX-27-69*	I-6-70*
Decapoda			
Palaemonetes vulgaris	2		
Crangon septemspinosa	15	1	15
Hippolyte pleuracantha	68	4	
Upogebia affinis	1		
Pagurus longicarpus	82	6	
Pagurus annulipes			
Callinectes sapidus			
Cancer irroratus			
Carcinus maenus			
Neopanope texana	5		
Panopeus herbstii	2		
Pinnotheres maculatum			
Pinnixa chaetopterana	121	1	1
Libinia dubia	2		
Decapoda juv.			
Sipunculida			
Phascolion strombi	3		
Sipunculid sp.			
Echiurid sp.			
Asteroid sp.			
Ophiuroidea			
Amphioplus abditus	1		
Echinoid sp.	1		
Holothuroidea			
Cucumaria pulcherrima			
Leptosynapta sp.	8		
Enteropneusta			
Ascidiacea			
Bostrichobranchus pilularis			
Perophora viridis			
Pisces	3		1

TOTAL INDIVIDUALS	718	26	22
TOTAL SPECIES	24	8	5
TOTAL NO. OF MISC. ANIMALS	892	28	61

*TRAWL SAMPLES

STATION–30 **MISCELLANEOUS GROUPS** **SAMPLE SIZE $\frac{1}{25}$ M^2**

SPECIES	IX-27-69	X-10-69	XI-17-69	XII-17-69	VI-17-70	IX-30-70	II-22-71			
Porifera							10			
Coelenterata										
Cerianthus americanus										
Sp. A										
Sp. B	2						2			
Sp. C										
Sp. D		4								
Turbellaria										
Sp. A		2					1			
Acoela Sp. A										
Acoela Sp. B										
Nemertina										
Tubulanus pellucidus	2	27	4			13	39			
Sp. B	4	3			1		9			
Sp. C	1				5					
Sp. D	3	6								
Nemertine juvs.				1		12	5			
Kinorhyncha										
Archiannelida					1		28			
Oligochaeta	257	62	226	27	487	247	143			
Polyplacophora										
Acarina		48	7			2	3			
Pycnogonida										
Tanystylum orbiculare										
Callipallene brevirostris							2			
Anoplodactylus lentus										
Pycnogonid juv.										
Cephalocarida										
Hutchinsoniella macracantha										
Ostracoda	20	9	2				4			
Cirripedia			4			2				
Mysidacea										
Cumacea										
Cyclaspis varians										
Leptocuma minor										
Leucon americanus										
Diastylis quadrispinosa										
Diastylis sp.										
Oxyurostylis smithi					3	2				
Cumacean juv.										
Tanaidacea										
Leptochelia savignyi										
Leptognathia sp.										
Isopoda										
Chiridotea tuftsi										
Idotea baltica										
Edotea montosa										
Erichsonella fil'formis						1				
Erichsonella sp.										
Anthurid sp. (Ptilanthura?)				3	1					
Sphaeroma quadridentatum										

STATION–30 (cont.) **MISCELLANEOUS GROUPS**

SPECIES	IX-27-69	X-10-69	XI-17-69	XII-17-69	VI-17-70	IX-30-70	II-22-71
Decapoda							
Palaemonetes vulgaris							
Crangon septemspinosa							
Hippolyte pleuracantha		1					
Upogebia affinis							
Pagurus longicarpus						1	
Pagurus annulipes							
Callinectes sapidus							
Cancer irroratus							
Carcinus maenus							
Neopanope texana							
Panopeus herbstii	1					3	3
Pinnotheres maculatum							
Pinnixa chaetopterana	1	1					5
Libinia dubia		2				1	
Decapoda juv.							
Sipunculida							
Phascolion strombi						2	10
Sipunculid sp.							
Echiurid sp.							
Asteroid sp.							1
Ophiuroidea							
Amphioplus abditus							
Echinoid sp.							
Holothuroidea							
Cucumaria pulcherrima							
Leptosynapta sp.							
Enteropneusta		2					1
Ascidiacea							
Bostrichobranchus pilularis					2		
Perophora viridis							
Pisces							

TOTAL INDIVIDUALS	14	46	4	3	13	23	100
TOTAL SPECIES	7	8	1	1	6	7	10
TOTAL NO. OF MISC. ANIMALS	291	167	243	31	500	286	266

A(82)

STATION—31 MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{25}$ M^2 EXCEPT WHERE OTHERWISE NOTED

SPECIES	IX-19-69	IX-25-69	X-24-69	XI-17-69	XII-22-69	III-3-70¹	V-12-70	VI-12-70	VII-14-70	VIII-18-70	IX-29-70	XI-10-70	XII-22-70	I-13-71	III-2-71	VI-9-71	VIII-24-71	XII-29-71	III-23-71	IX-3-72	I-19-73
Porifera			NONE ALIVE										NONE ALIVE								
Coelenterata																					
Ceriantheus americanus																					
Sp. A										7											
Sp. B																					
Sp. C	4																				
Sp. D																					
Turbellaria																					
Sp. A							1		4	26	7			1		3	11				
Acoela Sp. A				1					1												
Acoela Sp. B																					
Nemertina																					
Tubulanus pellucidus																					
Sp. B									1												
Sp. C																					
Sp. D																	1				
Nemertine juvs.																					
Kinorhyncha		1									2			1							
Archiannelida																					
Oligochaeta		2		1			9	2	3						23		9	1	1	4	
Polyplacophora																					
Acarina	3				9	1			1	1				1						2	
Pycnogonida																					
Tanystylum orbiculare																					
Callipallene brevirostris	2																2				
Anoplodactylus lentus																					
Pycnogonid juv.																					
Cephalocarida																					
Hutchinsoniella macracantha																					
Ostracoda	2										1										
Cirripedia	4																				
Mysidacea																					
Cumacea																					
Cyclaspis varians	9																				
Leptocuma minor																					
Leucon americanus																					
Diastylis quadrispinosa																					
Diastylis sp.																					
Oxyurostylis smithi	1											6		1						1	1
Cumacean juv.																					
Tanaidacea																					
Leptochelia savignyi	6	1																			
Leptognathia sp.	12																				
Isopoda																					
Chiridotea tuftsi																					
Idotea baltica															1						
Edotea montosa	1																				
Erichsonella filiformis																					
Erichsonella sp.																					
Anthurid sp. (Ptilanthura?)	1																				
Sphaeroma quadridentatum	7																				

STATION–31 (cont.) MISCELLANEOUS GROUPS

SPECIES	IX-19*69	IX-25-69	X-24-69	XI-17-69	XII-22-69	III-3-70†	V-12-70	VI-12-70	VII-14-70	VIII-18-70	IX-29-70	XI-10-70	XII-22-70	I-13-71	III-2-71	VI-9-71	VIII-24-71	XII-29-71	III-23-71	IX-3-72	I-19-73
Decapoda			NONE ALIVE										NONE ALIVE								
Palaemonetes vulgaris	56										1										
Crangon septemspinosa												1									
Hippolyte pleuracantha									1												
Upogebia affinis																					
Pagurus longicarpus	1																				
Pagurus annulipes																					
Callinectes sapidus											2				1						
Cancer irroratus																					
Carcinus maenus	1																				
Neopanope texana																					
Panopeus herbstii	9										1			1			2				
Pinnotheres maculatum																					
Pinnixa chaetopterana	9														1						
Libinia dubia																					
Decapoda juv.																					
Sipunculida																					
Phascolion strombi																					
Sipunculid sp.	1						1	1													
Echiurid sp.																					
Asteroid sp.																					
Ophiuroidea																					
Amphioplus abditus																					
Echinoid sp.																					
Holothuroidea																					
Cucumaria pulcherrima																					
Leptosynapta sp.																					
Enteropneusta																					
Ascidiacea																					
Bostrichobranchus pilularis																					
Perophora viridis																					
Pisces	1																				
TOTAL INDIVIDUALS	120	1	0	1	0	0	2	1	8	33	11	7	0	4	3	3	16	0	0	1	1
TOTAL SPECIES	15	1	0	1	0	0	2	1	5	2	4	2	0	4	3	1	4	0	0	1	1
TOTAL NO. OF MISC. ANIMALS	130	4	0	2	9	1	11	3	12	34	14	7	0	6	26	3	25	1	1	7	1

*TRAWL SAMPLE

† 1/10 M² VAN VEEN GRAB SAMPLE

STATION—35 MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	X-16-69	XI-13-69	XII-18-69	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	I-4-71	II-19-71	VIII-25-71						
Porifera																				
Coelenterata																				
Cerianthus americanus																				
Sp. A																				
Sp. B																				
Sp. C																				
Sp. D																				
Turbellaria																				
Sp. A			1			1				2										
Acoela Sp. A					1				3	4										
Acoela Sp. B				3	1															
Nemertina																				
Tubulanus pellucidus	26	27	13	25	12		11	3	7	62	67	17	34	52						
Sp. B	36	25	23	29	31	12	14	10	1	10	23	5	19	13						
Sp. C				2																
Sp. D						1														
Nemertine juvs.					2							1								
Kinorhyncha	5		1	11	9	2	26	19	1			8	18	16						
Archiannelida													3							
Oligochaeta	124	113	122	110	48	49	83	133	11	81	59	125	52	93						
Polyplacophora																				
Acarina	25	4		39	9	41	34	16		11	9	6	38	48						
Pycnogonida																				
Tanystylum orbiculare																				
Callipallene brevirostris																				
Anoplodactylus lentus	2		1																	
Pycnogonid juv.																				
Cephalocarida																				
Hutchinsoniella macracantha	2								14	14	3									
Ostracoda		22	15	11	4		8	14		47	8	1	67	71						
Cirripedia																				
Mysidacea																				
Cumacea																				
Cyclaspis varians																				
Leptocuma minor											1									
Leucon americanus												1								
Diastylis quadrispinosa																				
Diastylis sp.																				
Oxyurostylis smithi		1		1	2	2				7	8	1								
Cumacean juv.																				
Tanaidacea																				
Leptochelia savignyi														2						
Leptognathia sp.																				
Isopoda																				
Chiridotea tuftsi																				
Idotea baltica																				
Edotea montosa										2	4	3								
Erichsonella filiformis																				
Erichsonella sp.																				
Anthurid sp. (Ptilanthura?)																				
Sphaeroma quadridentatum																				

STATION—35 (cont.)

MISCELLANEOUS GROUPS

SPECIES	X-16-69	XI-13-69	XII-18-69	III-19-70	IV-6-70	V-12-70	VI-12-70	VII-13-70	VIII-11-70	IX-29-70	XI-10-70	I-4-71	II-19-71	VIII-25-71							
Decapoda																					
Palaemonetes vulgaris																					
Crangon septemspinosa					1	1															
Hippolyte pleuracantha																					
Upogebia affinis																					
Pagurus longicarpus		1																			
Pagurus annulipes			4	4										3							
Callinectes sapidus																					
Cancer irroratus																					
Carcinus maenus																					
Neopanope texana	2																				
Panopeus herbstii					1			1	1	1				12							
Pinnotheres maculatum																					
Pinnixa chaetopterana	1	4	9	3	1	3	4		12	2	3		1	4							
Libinia dubia																					
Decapoda juv.																					
Sipunculida																					
Phascolion strombi	1	16	11	12	12	3	5	1		8	22	4	12	4							
Sipunculid sp.									5	2											
Echiurid sp.																					
Asteroid sp.														1							
Ophiuroidea																					
Amphioplus abditus										4	1	1									
Echinoid sp.																					
Holothuroidea																					
Cucumaria pulcherrima																					
Leptosynapta sp.																					
Enteropneusta				7	3	2				1				17							
Ascidiacea																					
Bostrichobranchus pilularis	14	1	7	1					1				1								
Perophora viridis																					
Pisces																					
TOTAL INDIVIDUALS	84	75	69	80	62	23	34	15	44	118	132	32	70	91							
TOTAL SPECIES	8	7	8	9	9	7	4	4	8	12	9	7	6	8							
TOTAL NO. OF MISC. ANIMALS	238	214	207	258	137	117	185	197	56	258	208	173	248	336							

STATION—37 MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	XI-13-69							
Porifera								
Coelenterata								
Cerianthus americanus								
Sp. A								
Sp. B								
Sp. C								
Sp. D								
Turbellaria								
Sp. A								
Acoela Sp. A								
Acoela Sp. B								
Nemertina								
Tubulanus pellucidus	6							
Sp. B	10							
Sp. C								
Sp. D								
Nemertine juvs.								
Kinorhyncha	2							
Archiannelida								
Oligochaeta								
Polyplacophora								
Acarina	8							
Pycnogonida								
Tanystylum orbiculare								
Callipallene brevirostris								
Anoplodactylus lentus								
Pycnogonid juv.								
Cephalocarida								
Hutchinsoniella macracantha								
Ostracoda								
Cirripedia								
Mysidacea								
Cumacea								
Cyclaspis varians								
Leptocuma minor								
Leucon americanus								
Diastylis quadrispinosa								
Diastylis sp.								
Oxyurostylis smithi								
Cumacean juv.								
Tanaidacea								
Leptochelia savignyi								
Leptognathia sp.								
Isopoda								
Chiridotea tuftsi								
Idotea baltica								
Edotea montosa								
Erichsonella filiformis								
Erichsonella sp.								
Anthurid sp. (Ptilanthura?)								
Sphaeroma quadridentatum								

STATION—37 (cont.) MISCELLANEOUS GROUPS

SPECIES	XI-13-69								
Decapoda									
Palaemonetes vulgaris									
Crangon septemspinosa									
Hippolyte pleuracantha									
Upogebia affinis									
Pagurus longicarpus	1								
Pagurus annulipes									
Callinectes sapidus									
Cancer irroratus									
Carcinus maenus									
Neopanope texana									
Panopeus herbstii									
Pinnotheres maculatum									
Pinnixa chaetopterana									
Libinia dubia									
Decapoda juv.									
Sipunculida									
Phascolion strombi	2								
Sipunculid sp.									
Echiurid sp.									
Asteroid sp.									
Ophiuroidea									
Amphioplus abditus									
Echinoid sp.									
Holothuroidea									
Cucumaria pulcherrima									
Leptosynapta sp.									
Enteropneusta	1								
Ascidiacea									
Bostrichobranchus pilularis	3								
Perophora viridis									
Pisces									
TOTAL INDIVIDUALS	30								
TOTAL SPECIES	5								
TOTAL NO. OF MISC. ANIMALS	41								

STATION—80 MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{25}$ M^2

SPECIES	VI-12-70	XI-18-70	VI-10-71
Porifera			
Coelenterata			
Cerianthus americanus			
Sp. A			
Sp. B			
Sp. C			
Sp. D			
Turbellaria			
Sp. A	4	3	
Acoela Sp. A			2
Acoela Sp. B			2
Nemertina			
Tubulanus pellucidus	15	21	
Sp. B	3	13	
Sp. C			
Sp. D			
Nemertine juvs.		16	1
Kinorhyncha			
Archiannelida	10	79	31
Oligochaeta	193	378	420
Polyplacophora			
Acarina	8	16	23
Pycnogonida			
Tanystylum orbiculare			
Callipallene brevirostris			
Anoplodactylus lentus			
Pycnogonid juv.			
Cephalocarida			
Hutchinsoniella macracantha			
Ostracoda	42	41	58
Cirripedia		105	1
Mysidacea			4
Cumacea			
Cyclaspis varians			
Leptocuma minor		1	1
Leucon americanus			
Diastylis quadrispinosa			
Diastylis sp.			
Oxyurostylis smithi		1	2
Cumacean juv.			
Tanaidacea			
Leptochelia savignyi		1	
Leptognathia sp.			41
Isopoda			
Chiridotea tuftsi			
Idotea baltica			
Edotea montosa			
Erichsonella filiformis			
Erichsonella sp.			
Anthurid sp. (Ptilanthura?)			
Sphaeroma quadridentatum			

STATION—80 (cont.) MISCELLANEOUS GROUPS

SPECIES	VI-12-70	XI-18-70	VI-10-71
Decapoda			
Palaemonetes vulgaris			
Crangon septemspinosa			
Hippolyte pleuracantha			
Upogebia affinis			
Pagurus longicarpus		9	
Pagurus annulipes			
Callinectes sapidus			
Cancer irroratus			
Carcinus maenus			
Neopanope texana			
Panopeus herbstii	2	9	
Pinnotheres maculatum			
Pinnixa chaetopterana			
Libinia dubia			
Decapoda juv.			
Sipunculida			
Phascolion strombi	3	14	
Sipunculid sp.			
Echiurid sp.			
Asteroid sp.			
Ophiuroidea			
Amphioplus abditus		1	
Echinoid sp.			
Holothuroidea			
Cucumaria pulcherrima			
Leptosynapta sp.			
Enteropneusta			
Ascidiacea			
Bostrichobranchus pilularis		1	
Perophora viridis			
Pisces			
TOTAL INDIVIDUALS	37	153	79
TOTAL SPECIES	6	12	6
TOTAL NO. OF MISC. ANIMALS	260	709	586

STATION–90 **MISCELLANEOUS GROUPS** **SAMPLE SIZE $^1/_{25}$ M^2**

SPECIES	VIII-14-70	XI-18-70	I-4-71	II-22-71	IV-26-71	VI-10-71	VII-2-71	VIII-26-71
Porifera	1							
Coelenterata								
Cerianthus americanus				2				
Sp. A								
Sp. B								
Sp. C								
Sp. D								
Turbellaria								
Sp. A	2	1	1		1	1	1	
Acoela Sp. A								
Acoela Sp. B								
Nemertina								
Tubulanus pellucidus	4	101	51	67	105	73	57	89
Sp. B	1	31	16		17	14	1	
Sp. C								
Sp. D				2				
Nemertine juvs.								
Kinorhyncha	1	1	1	1	5	22	6	
Archiannelida				1			1	
Oligochaeta	102	67	53	25	65	50	76	36
Polyplacophora								
Acarina	2	1	1	4		40	1	
Pycnogonida								
Tanystylum orbiculare								
Callipallene brevirostris								
Anoplodactylus lentus								
Pycnogonid juv.								
Cephalocarida								
Hutchinsoniella macracantha				1	4	2		
Ostracoda	5	9		18	27	71	17	
Cirripedia								
Mysidacea						2		
Cumacea								
Cyclaspis varians								
Leptocuma minor								
Leucon americanus								
Diastylis quadrispinosa				1		1		
Diastylis sp.								
Oxyurostylis smithi	1	4	1		1			
Cumacean juv.							1	
Tanaidacea								
Leptochelia savignyi								
Leptognathia sp.								
Isopoda								
Chiridotea tuftsi								
Idotea baltica								
Edotea montosa		15	3	3	1		1	
Erichsonella filiformis				1				
Erichsonella sp.								
Anthurid sp. (Ptilanthura?)								
Sphaeroma quadridentatum								

STATION–90 (cont.) **MISCELLANEOUS GROUPS**

SPECIES	VIII-14-70	XI-18-70	I-4-71	II-22-71	IV-26-71	VI-10-71	VII-2-71	VIII-26-71
Decapoda								
Palaemonetes vulgaris								
Crangon septemspinosa	1							
Hippolyte pleuracantha								
Upogebia affinis								
Pagurus longicarpus						1	1	
Pagurus annulipes								
Callinectes sapidus								
Cancer irroratus							2	
Carcinus maenus								
Neopanope texana								
Panopeus herbstii								
Pinnotheres maculatum								
Pinnixa chaetopterana	2			2		1		
Libinia dubia								
Decapoda juv.								
Sipunculida								
Phascolion strombi		6		8	5	1		
Sipunculid sp.								
Echiurid sp.					1			
Asteroid sp.								
Ophiuroidea								
Amphioplus abditus								
Echinoid sp.								
Holothuroidea								
Cucumaria pulcherrima								
Leptosynapta sp.								
Enteropneusta	9	2		7	1	4		
Ascidiacea								
Bostrichobranchus pilularis								
Perophora viridis								
Pisces								
TOTAL INDIVIDUALS	11	158	72	88	135	94	65	89
TOTAL SPECIES	6	6	5	10	6	8	8	1
TOTAL NO. OF MISC. ANIMALS	131	238	127	143	233	283	165	125

MISCELLANEOUS GROUPS SAMPLE SIZE $\frac{1}{128}$ M^2

STATION—SIPPEWISSETT MARSH

SPECIES		SIPP 3		SIPP 4		SIPP 7		SIPP 8	
		II-24-70		II-24-70		VIII-6-70		VIII-13-70	I-11-71
Porifera									
Coelenterata									
Ceriantheus americanus									
Sp. A									
Sp. B									
Sp. C								2	
Sp. D									
Turbellaria									
Sp. A		1		1		1			4
Acoela Sp. A									
Acoela Sp. B									
Nemertina									
Tubulanus pellucidus									
Sp. B									
Sp. C									
Sp. D									
Nemertine juvs.								2	
Kinorhyncha									
Archiannelida									
Oligochaeta		1				24		1	
Polyplacophora									
Acarina		2							1
Pycnogonida									
Tanystylum orbiculare									
Callipallene brevirostris									
Anoplodactylus lentus									
Pycnogonid juv.									
Cephalocarida									
Hutchinsoniella macracantha									
Ostracoda		108				62		93	1
Cirripedia									
Mysidacea									
Cumacea									
Cyclaspis varians									
Leptocuma minor									
Leucon americanus									
Diastylis quadrispinosa									
Diastylis sp.									
Oxyurostylis smithi									
Cumacean juv.									
Tanaidacea									
Leptochelia savignyi						1		1	
Leptognathia sp.									
Isopoda									
Chiridotea tuftsi									
Idotea baltica									
Edotea montosa		1		1		6		24	1
Erichsonella filiformis									
Erichsonella sp.									
Anthurid sp. (Ptilanthura?)									
Sphaeroma quadridentatum									

MISCELLANEOUS GROUPS

STATION— SIPPEWISSETT MARSH

SPECIES		SIPP 3 (CONT.) II-24-70		SIPP 4 II-24-70		SIPP 7 VIII-6-70		SIPP 8 VIII-13-70	SIPP 8 I-11-71
Decapoda									
Palaemonetes vulgaris									
Crangon septemspinosa									
Hippolyte pleuracantha									
Upogebia affinis									
Pagurus longicarpus									
Pagurus annulipes									
Callinectes sapidus									
Cancer irroratus									
Carcinus maenus									
Neopanope texana									
Panopeus herbstii									
Pinnotheres maculatum									
Pinnixa chaetopterana									
Libinia dubia									
Decapoda juv.									
Sipunculida									
Phascolion strombi									
Sipunculid sp.									
Echiurid sp.									
Asteroid sp.									
Ophiuroidea									
Amphioplus abditus									
Echinoid sp.									
Holothuroidea									
Cucumaria pulcherrima									
Leptosynapta sp.									
Enteropneusta									
Ascidiacea									
Bostrichobranchus pilularis									
Perophora viridis									
Pisces									
TOTAL INDIVIDUALS		2		2		8		27	5
TOTAL SPECIES		2		2		3		3	2
TOTAL NO. OF MISC. ANIMALS		113		2		94		123	7

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APPENDIX B

Addenda et Corrigenda to Appendix A

POLYCHAETES

Lumbrinereis should read *Lumbrineris*
Stauronereis caeca should read *Dorvillea caeca*
Stauronereis rudolphi should read *Schistomeringos rudolphi*
Prionospio should read *Minuspio*
Maldanopsis should read *Asychis*
Capitella capitata should read *Capitella* spp.

6 1/2"

Station II	III-31-70	sum of species should read 7
	I-11-70	should read I-11-71
	I-11-71	sum of species should read 7
Station IV	XII-7-69	sum of species should read 4
	VIII-6-70	sum of species should read 7
	first X-2-70	sum of species should read 8
	second X-2-70	sum of species should read 7
	III-1-71	sum of species should read 8
	XII-17-71	1 individual, *Heteromastus filiformis;* sum of individuals should read 231; sum of species should read 12
	V-26-72	7 individuals, *Streblospio benedicti;* sum of individuals should read 305; sum of species should read 9
Station 5	VIII-14-70	55 individuals, *Protodorvillea gaspeensis;* sum of individuals should read 12,500; sum of species should read 41
Station 7	second XII-17-69	sum of species should read 19
Station 9	IV-8-70	sum of species should read 8
Station 10	IX-29-70	63 individuals of *Chaetozone* sp.; sum of indviduals should read 5876; sum of species should read 27

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Station 31	XII-22-70 III-2-71	Sum of species should read 13 Sum of species should read 13
Station 35	XII-18-69	1 individual, *Flabelligera affinis*, NOT *Pherusa affinis*
	IV-6-70	2 individuals, *Flabelligera affinis*, NOT *Pherusa affinis*
Station 90	VI-10-71	Sum of species should read 25

BIVALVES

Station 9	II-19-71	2 individuals, *Tagelus divisus*, NOT *Solemya velum*
Station 10	IV-6-70	1 individual, *Cerastoderma pinnulatum*, sum of individuals should read 5
Station 20	II-19-71	1 individual, *Pandora gouldiana;* sum of individuals should read 19
Station 35	VIII-11-70	Sum of individuals should read 102; sum of species should read 11

GASTROPODS

Retusa should read *Acteocina*

Station 5	VII-22-71	Should read II-22-71

AMPHIPODS

Station 5	IX-27-69	2 individuals, *Stenothoe minuta;* sum of individuals should read 23
	VIII-14-70	4 individuals, *Paracaprella tenuis;* sum of individuals should read 39; sum of species should read 10
Station 9	XII-29-71	Sum of species should read 3
Station 10	XII-8-69 IX-29-71 III-23-72	Should read XII-18-69 Sum of species should read 1 Sum of species should read 2
Station 28	IX-19-69	Sum of species should read 19

MISCELLANEOUS GROUPS

Station 10	First XII-27-71	Total number misc. animals should read 939
Station 28	IX-19-69	Total number misc. animals should read 893
	I-6-70	Total number misc. animals should read 89